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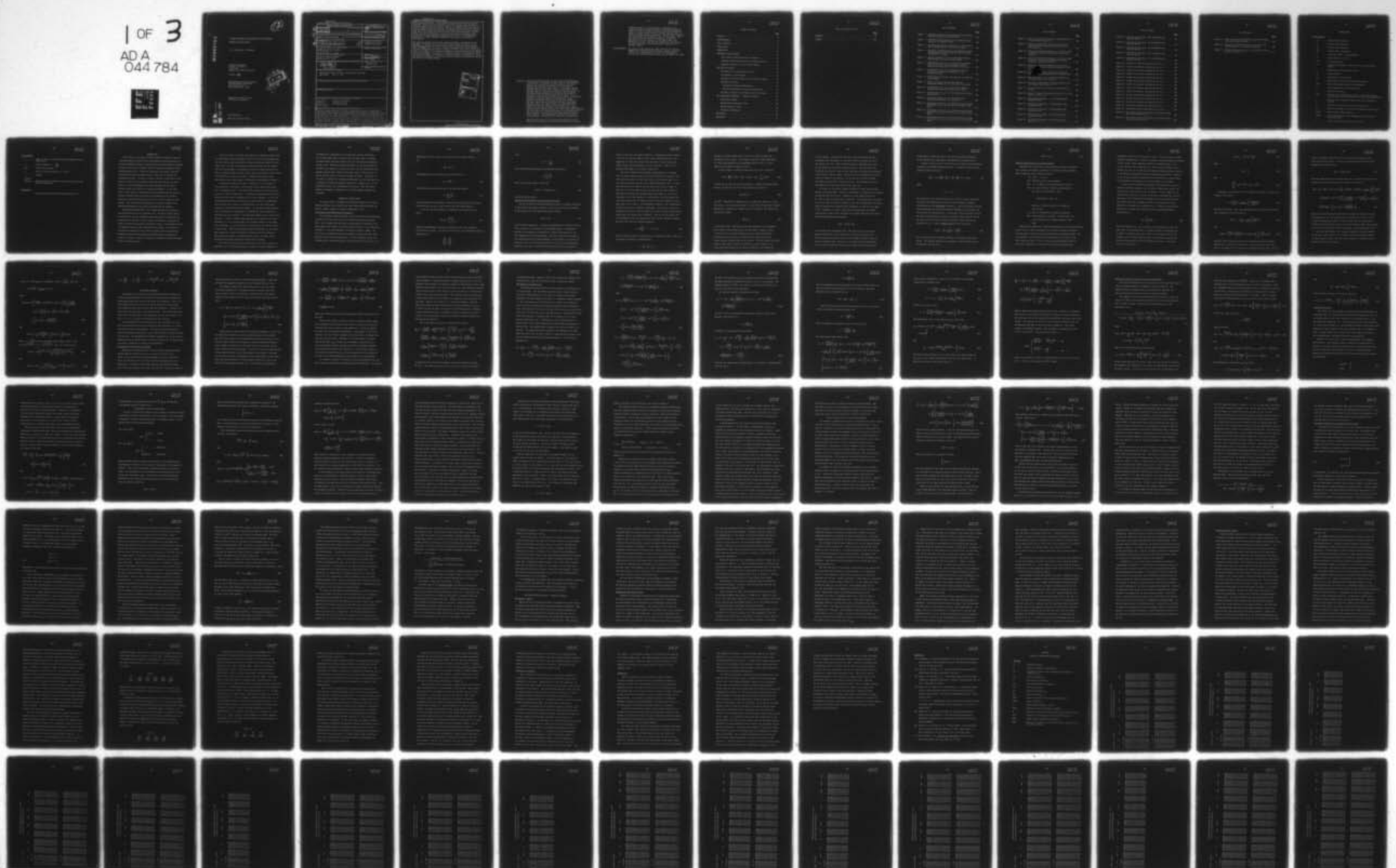

A THIRD PROCEDURE FOR LINEARIZED FULLY CAVITATING HYDROFOIL SECTION DESIGN

B. R. Parkin and J. Fernandez

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The third design procedure for fully cavitating hydrofoils is based upon a linearized inverse theory of two-dimensional cavity flows at arbitrary cavitation number. The cavity surfaces are assumed to originate at the leading and trailing edges of the wetted surface. This report reviews and completes the basic theory and gives detailed examples obtained from the resulting parametric design technique. In the third design procedure, one specifies the design lift coefficient, the cavitation number and the upper cavity thickness at two points

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along the profile chord. A prescribed pressure distribution shape is also selected. These quantities determine the profile design which consists of the upper cavity and wetted surface contours, the design angle of attack, the cavity length, the drag coefficient, the moment coefficient and the lift-to-drag ratio. The method also includes off-design calculations in accordance with the direct linearized theory of cavity flows which determines the flow states for which interference can occur between the upper surface of the cavity and the upper nonwetted surface of the profile. The hydrodynamic performance of specific "point designs" is also given by these direct calculations.

The chief new feature of the third design procedure is the ability of the designer to prescribe two points on the cavity surface instead of one as heretofore. Although certain constraints must be observed by the designer when specifying these two values of cavity thickness, the third procedure is found to be more general and more flexible than the first or second procedures studied previously. The necessary constraints are incorporated in the computer logic for the method. The fact that linearized theory is used tends to limit the applicability of the procedure to conceptual design and feasability studies. The computer program for the procedure has been found to be economical and well suited for its intended purpose.

Abstract: The third design procedure for fully cavitating hydrofoils is based upon a linearized inverse theory of two-dimensional cavity flows at arbitrary cavitation number. The cavity surfaces are assumed to originate at the leading and trailing edges of the wetted surface. This report reviews and completes the basic theory and gives detailed examples obtained from the resulting parametric design technique. In the third design procedure, one specifies the design lift coefficient, the cavitation number and the upper cavity thickness at two points along the profile chord. A prescribed pressure distribution shape is also selected. These quantities determine the profile design which consists of the upper cavity and wetted surface contours, the design angle of attack, the cavity length, the drag coefficient, the moment coefficient and the lift-to-drag ratio. The method also includes off-design calculations in accordance with the direct linearized theory of cavity flows which determines the flow states for which interference can occur between the upper surface of the cavity and the upper nonwetted surface of the profile. The hydrodynamic performance of specific "point designs" is also given by these direct calculations.

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Nomenclature

Roman Symbols

a	-	cavity length parameter
C_L	-	section lift coefficient
C_D	-	section drag coefficient
C_M	-	section moment coefficient
K	-	cavitation number = $(P_\infty - P_k)/(\rho U^2/2)$
ℓ	-	cavity length, $\ell = a^2 + 1$
L/D	-	lift-to-drag ratio
m	-	pressure amplification factor used in the second design method
p	-	nondimensional perturbation pressure
P_k	-	cavity pressure
P_∞	-	free-stream static pressure
s	-	peak pressure location, measured from the nose
t(x)	-	upper (non-wetted) surface of the hydrofoil
T	-	cavity thickness at the trailing edge
U	-	free stream velocity
W(a)	-	function used to compute the angle of attack corresponding to the cavity-foil interference in the off-design calculations
x	-	absissa, taken as positive downstream, with the origin at the nose
$\bar{x}$	-	distance of the center of pressure from the nose
x_o	-	chord wise location of second cavity-thickness control point
$y_u(x)$	-	cavity contour (upper surface)
$y_c(x)$	-	cavity thickness due to the complementary function (not total thickness)
z	-	complex variable in physical plane, z=x+iy

Greek Symbols

α - angle of attack of the chord line with respect to the free stream

β - cavity parameter, $1 - \frac{1}{\sqrt{1+K}}$

$\eta(x)$ - wetted surface shape

μ - ratio of cavity thickness to T at $x=x_o$

ρ - density

$\Xi_1(a,x)$,
$\Xi_2(a,x)$ - functions used to compute the cavity contour in the off-design calculations

Superscript

' - prime indicates differentiation with respect to x

INTRODUCTION

This study is the second of two investigations intended to provide a two-dimensional linearized theory and companion numerical methods [1] for the preliminary design of supercavitating or superventilated hydrofoil sections which will be consistant with the linearized mixed-foil theory of Wang and Shen [2,3]. Reference 2 describes the design of hydrofoil sections which embody good performance in both fully cavitating and noncavitating flows. In order to provide a profile of high lift-to-drag ratio in a cavity flow the designer prescribes the shape of the lower surface with the foreknowledge that his prescription of the wetted surface contour will achieve the intended performance. On the other hand, he must provide a low-drag section in noncavitating flow and also provide a profile which can tolerate a prescribed sea-state without suffering cavitation inception until after the take-off speed has been reached. Thus the pressure distribution of the upper surface of the noncavitating hydrofoil must also be controlled by the designer.

The linearized mixed-foil theory of Wang and Shen [2] pertains to two-dimensional foils in an unbounded fluid. The lower surface contour is specified in terms of high-speed superventilating or supercavitating performance and the upper surface pressure distribution is specified in terms of sea-state requirements for moderate speeds. The hydrofoil section of streamlined shape is then computed from the theory. The purpose of the present investigation is to arm the designer with the prerequisite knowledge of wetted surface shape and related cavity-flow parameters so that he will have a chance to execute his preliminary mixed-foil design without inordinant travail.

The first of the two studies noted above was a numerical design study [4] which explored the hydrodynamic aspects of fully cavitating hydrofoil section design in accordance with the linearized inverse theory of cavity flows [5,6]. In these calculations the cavity springs from the leading and the trailing edges of the hydrofoil so that the upper surface of the foil is contained inside the upper cavity contour and only the lower surface of the profile is wetted by the flow. A typical flow geometry and a prescribed pressure distribution is illustrated schematically in Figure 1.

Two design procedures were used in Reference 4. In the first of these procedures, the design is carried out at the ideal attack angle (or at "shockless entry"). The thin-airfoil analog of this first design procedure is given in Reference 7. In the cavity-flow problem the airfoil thickness distribution is replaced by the cavity thickness. In the first design procedure interference between the upper surface of the hydrofoil and the upper cavity contour is eliminated by use of the "point-drag" solution of linearized cavity-flow theory. In the second design procedure cavity interference is eliminated by increasing the attack angle above the shockless entry condition. The point-drag solution is not used in this procedure. In both of these design procedures one prescribes the cavity thickness, T, at the trailing edge, the cavitation number, K, the design lift coefficient, C_L, and the pressure distribution on the wetted surface of the profile. Then the hydrodynamic moment coefficient, C_M, the cavity drag coefficient C_D and the section lift-to-drag ratio are calculated. The design attack angle, the wetted surface contour, the upper cavity contour and the cavity length also follow from the theory.

The theoretical developments of References 5 and 6 also contain the ingredients of a third design procedure in which the cavity thickness is

controlled by a combination of the point-drag solution and the use of an attack angle which is greater than the ideal angle. Evidently the third design procedure contains the first and second procedures as special cases. Until now the third procedure has not been worked out in detail even though, as we shall see below, this procedure offers the designer somewhat more control of the upper cavity contour than he can obtain with the first or the second design procedures. Therefore, it is useful to complete the theoretical development for this procedure and to program the resulting numerical methods for a computer [1]. In the following sections, this development is described. Then some hydrodynamic and geometric consequences of the third design procedure are presented.

THEORETICAL PRELIMINARIES

In order to give a reasonably self-contained account of the third design procedure, we will outline the basic theory which underlies the method. Further details are given in References 5 and 6.

Flow Geometry and Characteristic Parameters

In the present linearized theory, we work with velocity perturbations created by the foil-cavity system in an otherwise steady rectilinear flow. Let us suppose that the chord of the profile is inclined at the small angle α with respect to the free stream velocity, U, as illustrated in Figure 1. The flow direction is from left to right as shown. Let us fix an x-y coordinate system at the profile nose and with the x axis parallel to the free stream direction. In this coordinate system, the trailing edge of the wetted surface (of unit chord) will be at $x=1$, $y=-\alpha$.

With respect to this system, we can write the free stream velocity as

$$\vec{q}_\infty = \{U,o\} \quad .$$

The magnitude of the velocity on the cavity surface is

$$q_c = U\sqrt{1+K} \quad , \tag{1}$$

which follows from the definition of the cavitation number,

$$K = \frac{P_\infty - P_k}{\frac{1}{2}\rho U^2} \quad , \tag{2}$$

and the application of Bernoulli's equation with P_∞ being the free stream static pressure, P_k the cavity pressure and ρ the liquid density.

If we use the cavity speed q_c to normalize the velocities we can write

$$\vec{q}(x,y) = \begin{Bmatrix} 1+u \\ v \end{Bmatrix} q_c \quad , \tag{3}$$

where the dimensionless disturbance velocities u and v are created by the foil and its cavity. Far upstream of the foil, the perturbation velocity components are

$$\begin{Bmatrix} u \\ v \end{Bmatrix} = \begin{Bmatrix} \beta \\ 0 \end{Bmatrix} \quad ,$$

with

$$\beta = 1 - \frac{1}{\sqrt{1+K}} \quad . \tag{4}$$

Let us define the dimensionless perturbation pressure p as

$$p = \frac{P - P_k}{\frac{1}{2} \rho U^2} \quad . \tag{5}$$

Then to first order terms, we must have

$$p(x,y) = -2(1+K)\, u(x,y) \quad , \tag{6}$$

and on the cavity, p=u=0.

Conformal Transformations and the Complete Solution

We can use certain conformal mappings in order to transform the domain of the flow in the z-plane (z=x+iy), in such a way that many key elements of the solution for the complex disturbance velocity,

$$w(z) = u-iv \quad , \tag{7}$$

can be found by inspection. In these transformations the complex velocity, w(z), is taken to be invariant at corresponding points. The method of solution is conveniently illustrated by a study of the geometry of the flow boundaries in the various planes. The first step in this process is the representation of the flow boundaries in the z-plane in a way that is consistant with the linearization implied by the use of the perturbation quantities u, v and p. All of these will be much smaller than unity as

long as α and K are also small quantities. Generally the wetted surface of the profile will be cambered with a camber distribution $\eta(x)$. The magnitude of η will also be much less than unity at every x along the wetted surface and in particular, $\eta=0$ at $x=0$ and $x=1$. That is, η is measured with respect to the profile chord line.

In order to simplify the following considerations let us imagine that the total complex perturbation velocity consists of two parts: the first part being that of a flat plate profile at an attack angle α and the second part being due only to the camber distribution $\eta(x)$. To first order accuracy we can replace the foil and cavity in the x-y plane of Figure 1 by a cut of length ℓ along the real axis as shown in Figure 2. This figure also shows the boundary values which apply to $w(z)$ for the flat-plate part of the solution. We can transform the flow outside the cut in the z-plane into the region outside of the unit semicircle in the upper half of the ζ plane. As illustrated in Figure 3, the transformation can be carried out by a sequence of mappings. In the first of these, we transform the point $x=\ell$ into the point at $+\infty$ with a bilinear transformation which leaves the points 0 and 1 invariant. Then we take the square root of this mapping to get the configuration shown in the ν plane of Figure 3. One can verify that the resultant mapping is

$$\nu = a\sqrt{\frac{z}{z-\ell}} \quad , \quad \ell = a^2 + 1 \quad . \tag{8}$$

Since the foil and cavity are mapped into the real axis in the ν plane, one now applies the Joukowski transformation,

$$\nu = \frac{1}{4}\left(\zeta + \frac{1}{\zeta}\right) - \frac{1}{2} \quad , \tag{9}$$

in order to map the wetted surface of the foil into the upper unit semicircle in the ζ plane. The boundary values on w which would apply to a flat plate hydrofoil at corresponding points in the z, ν and ζ planes are so marked in Figures 2 and 3.

In the ζ plane, one can write the solution for $w(\zeta)$ as follows:

$$w(\zeta) = \frac{2iA}{\zeta-1} + i\,\frac{B}{4}\,(\zeta - \frac{1}{\zeta}) + i(A+\alpha) - i[C_o + \sum_{n=1}^{\infty} C_n/\zeta^n] \quad . \tag{10}$$

In order to see that this is the solution for a cambered supercavitating profile, we note that the first term, $2iA/(\zeta-1)$, is equal to

$$A[\cot\frac{\theta}{2} - i] \tag{11}$$

on $\zeta=e^{i\theta}$. Therefore its imaginary part is simply the constant $-A$ on the unit circle. On the real axis where ζ is real this term is purely imaginary. Therefore it satisfies the condition $u=0$ on the cavity. The second term, $iB(\zeta-1/\zeta)/4$, equals

$$-\frac{B}{2}\sin\theta \tag{12}$$

on the unit circle. Therefore it does not contribute to the imaginary part of $w(\zeta)$ on the wetted surface of the profile. Moreover, when ζ is real this term is purely imaginary and so it also satisfies the condition $u=0$ on the cavity, as does the third term and also the Laurent series, provided that the C_n are real. The first three terms from Equation (10), and the Fourier coefficient C_o can be thought of as those terms which allow for the angle of attack (or flat plate) part

of the solution. We note also that these terms also provide for the branching of the streamlines at the profile nose $\zeta=1$ and at the end of the cavity, $x=\ell \leftrightarrow \zeta=\infty$. Both of these points are singularities of $w(\zeta)$, as one expects for linearized stagnation points. Thus the first term involving the constant A opens up the cavity and the second term involving the constant B closes it again. The Fourier series represents the contribution of camber to the solution. In the case of the direct problem the camber function $\eta(x)$ is known in advance. The coefficients C_n are determined by the derivative $d\eta/dx$ in the usual way.

Of course, in the present inverse problem the camber function $\eta(x)$ remains to be determined. Instead of specifying η, we prescribe the pressure distribution $p(x)$ on the foil. Therefore we will modify the form of Eq. (10) to make the specification convenient. This modification is guided by the fact that on the wetted surface of the foil the expression (12) shows that the second term of Equation (10) contributes to u but not to v when $\zeta=e^{i\theta}$. Therefore, if we add a term $iB/2\zeta$ to the solution, the above contribution to $u(\theta)$ will be cancelled by the added term and we can relate the prescribed pressure distribution,

$$p(\theta) = -2(1+K)\ u(\theta) \quad ,$$

to the camber term in Equation (10). Note that we will still have a separate contribution to the pressure on the profile from the first term of Equation (10) which is due to attack angle as shown by the real part of expression (11). This part of the total pressure distribution can not quite be prescribed arbitrarily although one can find an ideal

attack angle at which this first term (and the resulting singularity at the profile nose) will vanish, corresponding to shockless entry.

Finally we do not wish to be restricted to a Fourier series representation for the pressure distribution $p(\theta)$. Therefore we will write the modified complex velocity as

$$w_p(\zeta) = iA + \frac{2iA}{\zeta-1} + \frac{iB}{4}(\zeta - \frac{1}{\zeta}) + \frac{iB}{2\zeta} + iD + w_1(\zeta) \quad , \tag{13}$$

where

$$D = \alpha - C_o \quad .$$

The term $w_1(\zeta)$ is an analytic function of ζ which is regular everywhere in the flow and represents the effect of profile shape or pressure distribution upon the particular solution w_p. Now the particular solution has been designed to satisfy the boundary conditions on the profile and on the cavity as discussed above. We can add to this particular solution any other solution which is regular at infinity, which satisfies u=0 on the cavity and on the foil, and which produces a closed body in the interval $0 \leq x \leq \ell$. Such a complementary function is given by

$$w_c(z) = -\frac{E}{2}\left[\sqrt{\frac{z}{z-\ell}} + \sqrt{\frac{z-\ell}{z}}\right] \quad , \tag{14}$$

and it is known as the point-drag solution of linearized cavity flow theory. The complete solution of the problem is then given by the sum of Equations (13) and (14):

$$w(z) = w_p + w_c \quad . \tag{15}$$

Boundary Conditions for the Inverse Problem

Equation (15) is the form of solution which must now be applied so as to satisfy the boundary conditions on the present inverse problem. These conditions can be listed as follows:

(i) $w(z) = -\beta$ at $z=\infty$

(ii) $u(x,0\pm)=0$ on the cavity surfaces

(iii) $v = -\alpha + \frac{d\eta}{dx}$ on the wetted surface of the foil

(iv) the cavity together with the wetted surface of the foil is a closed body. Thus

$$\mathrm{Im} \oint w(z)dz = -2\pi a_1 = 0 \quad ,$$

where a_1 is the real part of the residue of $w(z)$ at $z=0$.

(v) $w(z)$ is continuous at $z=1$ (Kutta condition).

(vi) $u \leq 0$ everywhere in the flow. In particular, the cavity pressure is the lowest pressure in the flow.

Before we can apply these conditions and determine the various constants such as A, B, D, and E in Equation (15), we must determine the analytic function $w_1(z)$ in terms of the prescribed pressure distribution $p(x)$. For our purposes, it is sufficient to determine the value of $w_1(z)$ on the cavity and on the foil. In the ν plane, this can be done by means of the Hilbert transform or by certain direct integral-superposition

techniques as were used in References 5 and 6. In either case, the above boundary conditions give a system of equations involving definite integrals in the ν plane. These equations can then be transformed back to the z plane with the help of Equation (8). Because we are working with the function w_1 only, we can work with the various boundary conditions directly in the integral superposition without calculating w_1 explicity. However, we can not apply integral superposition to the problem as a whole because of the nonlinear involvement of the cavity length in the problem.

In any event we obtain from conditions (i) through (vi) a series of equations involving integrals over the wetted surface which contain the function p(x) as one factor in the integrands. We will simply list the results below; but before we can do so we need to determine the relative importance of the individual contributions from the prescribed pressure distribution and from the angle-of-attack or flat-plate part of the solution to the design lift coefficient C_L. In order to evaluate these effects, let us denote the contribution of the prescribed pressure distribution by

$$C_L' = \int_0^1 p(x)dx \quad . \tag{16}$$

Then the difference, $C_L - C_L'$, is equal to the contribution of the flat plate part of the solution and it is known that this contribution will be equal to $4\pi(1+K)b_1$, where b_1 is equal to the imaginary part of the residue at z=0 as derived from Equation (13) with the term w_1 deleted. The point-drag solution does not contribute to the lift. The final result can be written as

$$(1-m)C_L = -\frac{A}{2}\pi(1+K)\frac{\delta-a\varepsilon}{\sqrt{a}} \quad , \tag{17}$$

where

$$mC_L = C_L' \tag{18}$$

and

$$\left\{\begin{matrix}\delta\\ \varepsilon\end{matrix}\right\} = [\sqrt{\ell}+1]^{1/2} \pm [\sqrt{\ell}-1]^{1/2} \quad . \tag{19}$$

Returning to the employment of the boundary conditions, one finds that condition (iv) leads to

$$B = -\frac{A}{4}\frac{\varepsilon+a\delta}{a\ell\sqrt{a}} + \frac{m}{4\pi(1+K)a\ell}\int_0^1 \frac{(\ell-2x)p(x)}{\sqrt{x(\ell-x)}}dx \quad , \tag{20}$$

provided that $p(0)=0$. After some manipulation the two equations resulting from condition (i) can be written as

$$\frac{B}{2} + D = -\frac{A}{2}\frac{\delta}{\sqrt{a}} + \frac{m}{4\pi(1+K)}\int_0^1 \frac{p(x)}{\ell-x}dx \tag{21}$$

and

$$(1+K)\beta = \frac{(1-m)C_L}{2\pi\ell}\frac{(2a^2+3)\varepsilon+a\delta}{\delta-a\varepsilon} + (1+K)E + \frac{m}{2\pi\ell}\int_0^1 \sqrt{\frac{\ell-x}{x}}\,p(x)dx \quad . \tag{22}$$

Condition (ii) has been satisfied by the construction of the solution, Equation (15). Moreover, condition (v) is satisfied by the flat plate part of the solution as can be seen from Equations (11) and (12). It will

also be satisfied by that part due to the prescribed pressure as long as we require that $p(1)=0$. In fact it has been found [5] that the strict condition to be satisfied is

$$p(x) \sim 2(1+K)\,\lambda\sqrt{1-x} \tag{23}$$

near $x=1$, where $\lambda \geq 0$ may be selected arbitrarily. Condition (iii) gives the equation for the shape of the wetted surface. The result is

$$\begin{aligned}\eta(x) = {} & (C_o - \frac{B}{2})x + aB[\ell \tan^{-1}\sqrt{\frac{x}{\ell-x}} - \sqrt{x(\ell-x)}] - E\sqrt{x(\ell-x)} + \frac{m}{2\pi(1+K)}\Bigg\{\frac{x}{2}\int_0^1 \frac{p(x)dx}{\ell-x} \\ & - \frac{1}{2}[\sqrt{x(\ell-x)} + \ell\tan^{-1}\sqrt{\frac{x}{\ell-x}}]\int_0^1 \frac{p(x)dx}{\sqrt{x(\ell-x)}} + \tan^{-1}\sqrt{\frac{x}{\ell-z}}\int_0^1 p(x)\sqrt{\frac{x}{\ell-x}}\,dx \\ & + \frac{C_L}{2}\ell n(\frac{\ell}{\ell-x}) - \int_0^1 p(t)\,\ell n\left|1 - \sqrt{\frac{x(\ell-t)}{t(\ell-x)}}\right| dt\Bigg\}\end{aligned} \quad , \tag{24}$$

where we have used Equations (16) and (18) in order to introduce the term which depends on C_L. The satisfaction of condition (vi) will be strict in the following design method. We shall insist that the contributions of both flat-plate and prescribed pressure distributions shall always exceed zero on the wetted surface between the leading and trailing edges, $0<x<1$.

One last formula which is an important ingredient in profile design is the upper cavity contour. It is obtained from considerations similar to those leading to $\eta(x)$. When the cavity ordinate is measured from the profile chord line the result is

$$y(x) = \alpha x - 2a^2\ \ell A F_1(x,a) + aB[\sqrt{x(\ell-x)} - \ell\tan^{-1}\sqrt{\frac{x}{\ell-x}}] - (\frac{B}{2} + D)x$$

$$+ E\sqrt{x(\ell-x)} + \frac{m}{2\pi(1+K)}G(x,a;p) \quad , \qquad (25)$$

where

$$G(x,a;p) = \frac{x}{2}\int_0^1 \frac{p(x)dx}{\ell-x} + \frac{1}{2}[\sqrt{x(\ell-x)} + \ell\tan^{-1}\sqrt{\frac{x}{\ell-x}}]\int_0^1 \frac{p(x)dx}{\sqrt{x(\ell-x)}}$$

$$- \tan^{-1}\sqrt{\frac{x}{\ell-x}}\int_0^1 p(x)\sqrt{\frac{x}{\ell-x}}\,dx + \frac{C_L}{2}\ell n(\frac{\ell}{\ell-x})$$

$$- \int_0^1 p(t)\ \ell n\left|1 + \sqrt{\frac{x(\ell-t)}{t(\ell-x)}}\right| dt \qquad (26)$$

and

$$F_1(x,a) = \frac{1}{2a^2}[\frac{\nu\sqrt{\nu(\nu+1)}}{\nu^2+a^2} + \frac{\beta_1}{4\omega^2}L(\nu,a) + \frac{\beta_2}{2\omega^2}T(\nu,a)] \qquad (27)$$

with $\nu = a\sqrt{\frac{x}{\ell-x}}$ for $x\geq 0$ on the upper cavity surface and $\omega^2 = a\sqrt{\ell}$, $\beta_1 = -\sqrt{(\omega^2-a^2)/2}$, $\beta_2 = -\sqrt{(\omega^2+a^2)/2}$. The L and T functions are

$$L(\nu,a) = \ell n\left\{a^2[\frac{\{\gamma_1\nu + \delta_1 - \sqrt{\nu(\nu+1)}\}^2+(\gamma_2\nu + \delta_2)^2}{(\delta_1^2 + \delta_2^2)(\nu^2 + a^2)}]\right\} \qquad (28)$$

and

$$T(\nu,a) = \tan^{-1}\frac{\gamma_2\nu + \delta_2}{\gamma_1\nu + \delta_1 - \sqrt{\nu(\nu+1)}} - \tan^{-1}\frac{\delta_2}{\delta_1} - \tan^{-1}\frac{\nu}{a} \quad , \qquad (29)$$

$$\delta_1 = \frac{a\beta_2}{2\omega^2} \quad , \quad \delta_2 = \frac{a\beta_1}{2\omega^2} \quad , \quad \gamma_1 = \frac{a\beta_2 + \beta_1/2}{\omega^2} \quad \text{and} \quad \gamma_2 = \frac{a\beta_1 - \beta_2/2}{\omega_2} \quad .$$

THE DESIGN PROCEDURE

As explained at the outset, the third design procedure contains the first and second procedures as special cases because both flat plate and point drag solutions are used to control the cavity geometry. Thus if it should happen that A=0 or E=0, these special cases will be the outcome of calculations based upon the prescribed input parameters. Neither A nor E will have been set equal to zero from the start. The various parameters which have been identified in the problem thus far are the constants A, B, C_o, E, α, ℓ, K, m, C_L and the functions p(x), η(x) and y(x).

In the formulation of the design process the two constants K and C_L will be prescribed from the outset and of the three functions, p, η and y, only p(x) will be an input quantity. The outputs of the design process will be the geometric parameters, α and ℓ and the cavity and profile shapes, y(x) and η(x). The hydrodynamic performance parameters C_D, C_m and related parameters such as L/D and center of pressure location $\bar{x}$ at the design point will also be considered as primary output quantities.

Provisions for a Determinate Procedure

Naturally, the determination of the above primary output quantities depends upon the evaluation of A, B, C_o, m and E in terms of the inputs. Thus, when we add these five parameters to the two unknowns, α and m, we find that there is a total of seven unknown quantities to be determined. At present, we have found only four relationships between them. These are Equations (17), (20), (21) and (22). Three more relation-

ships are needed to produce a determinate design procedure. These may be found from additional conditions on the functions $\eta(x)$ and $y(x)$.

For example, consider the camber function $\eta(x)$. We have stated that these ordinates are to be measured from the profile chord line. This can only be true if the arbitrary constants in Eq. (23) satisfy explicitly the condition $\eta(1)=0$. Thus, we must have the added relationship,

$$0 = \alpha - (\frac{B}{2} + D) + aB[\ell \tan^{-1}\frac{1}{a} - a] - aE + \frac{m}{2\pi(1+K)}\left\{\frac{1}{2}\int_0^1 \frac{p(x)dx}{\ell - x}\right.$$

$$- \frac{1}{2}(a + \ell \tan^{-1}\frac{1}{a})\int_0^1 \frac{p(x)dx}{\sqrt{x(\ell-x)}} + \tan^{-1}\frac{1}{a}\int_0^1 p(x)\sqrt{\frac{x}{\ell-x}}\,dx + \frac{C_L}{2}\,\ell n\,\frac{\ell}{a^2}$$

$$\left. - \int_0^1 p(x)\,\ell n\left|1 - \frac{1}{a}\sqrt{\frac{\ell-x}{x}}\right|dx\right\} \quad . \tag{30}$$

Another point is that we have not yet made any provision to insure that the upper cavity contour will clear the wetted surface of the profile and still leave enough room for the hydrofoil structure inside the cavity. Since we require two more relationships to make the problem determinate, we can impose two conditions on the upper contour of the cavity and use them to control the cavity clearance. One of these can be the specification of the cavity thickness at the trailing edge of the profile. Recalling from Eq. (25) that $y(x)$ is measured from the profile chord, we take $y(1)=T$, where the cavity thickness T is now an input parameter as it was in the first and second design procedures [4]. The resulting relationship is

$$T = \alpha + \frac{(1-m)C_L}{\pi(1+K)} \cdot \frac{4a^2\,\ell\sqrt{a}}{\delta-a\varepsilon} F_1(1,a) + [a-\ell \tan^{-1}\frac{1}{a}] \left\{\frac{(1-m)C_L}{2\pi(1+K)} \cdot \frac{\varepsilon+a\delta}{\ell(\delta-a\varepsilon)}\right.$$

$$\left. + \frac{m}{4\pi(1+K)\ell}\int_0^1 \frac{(\ell-2x)p(x)}{\sqrt{x(\ell-x)}}\,dx\right\} - \frac{(1-m)C_L}{\pi(1+K)} \cdot \frac{\delta}{\delta-a\varepsilon} - \frac{m}{4\pi(1+K)}\int_0^1 \frac{p(x)dx}{\ell-x}$$

$$+ a\beta - \frac{(1-m)C_L}{2\pi(1+K)} \cdot \frac{a}{\ell} \cdot \frac{(2a^2+3)\varepsilon + a\delta}{\delta-a\varepsilon} - \frac{m}{2\pi(1+K)} \cdot \frac{a}{\ell}\int_0^1 \sqrt{\frac{\ell-x}{x}}\,p(x)dx$$

$$+ \frac{m}{2\pi(1+K)} G(1,a;p) \quad , \qquad (31)$$

where the functions F_1 and G have already been defined in Equations (26) and (27).

Next we will require the cavity to have a specified ordinate equal to μT, measured from the profile chord line at a point x_o near the nose. Obviously the factor μ will be in the range $0<\mu<1$. We can not specify the value of μ with complete arbitrariness. For example, if the cavity pressure is to be the lowest pressure in the flow field, it follows that the cavity must be convex. Therefore if T is prescribed, it follows that we must have $\mu>x_o$, because $\mu=x_o$ corresponds to $y(x_o)$ being on a line drawn between the nose and the point (1,T), where these ordinates are measured with respect to the chord line. As a practical matter, it is desirable to make the cavity as thick as possible in the vicinity of the nose so that the leading edge of the profile can be strengthened.

The condition $y(x_o)=\mu T$ is certainly not the only possibility for the last condition needed to make the design procedure determinate. For example

an alternative condition which we have not investigated but which could have some advantages in a design procedure, is $y(x_o)-\eta(x_o)=\omega T$, where ω is a new parameter which measures the clearance between the upper surface of the cavity and the wetted surface of the foil at the point x_o. This alternate condition could be used to make certain from the outset that there is no interference between cavity and foil near the nose. The condition which we have adopted in the present method will not permit us to guarantee non-interference from the start. However, as we shall see, μ can be prescribed in a limited range which depends in each instance upon the input parameters K, C_L and T as well as upon the shape of the pressure distribution, p(x). Therefore, one can avoid interference by designing a number of profiles for various μ-values in the permissible range and selecting the preferred design from the several possibilities.

Use of the condition $y(x_o)=\mu T$ in Equation (25) leads to

$$\frac{\mu T}{x_o} = \alpha + \frac{(1-m)C_L}{\pi(1+K)} \cdot \frac{4a^2\ell\sqrt{a}}{\delta-a\varepsilon}\,\frac{F_1(x_o,a)}{x_o} + \left[\sqrt{\frac{(\ell-x_o)}{x_o}} - \frac{\ell}{x_o}\tan^{-1}\sqrt{\frac{x_o}{\ell-x_o}}\right]$$

$$\times\left\{\frac{(1-m)C_L}{2\pi(1+K)} \cdot \frac{\varepsilon+a\delta}{\ell(\delta-a\varepsilon)} + \frac{m}{4\pi(1+K)\ell}\int_0^1 \frac{(\ell-2x)p(x)}{\sqrt{x(\ell-x)}}\,dx\right\} - \frac{(1-m)C_L}{\pi(1+K)}\,\frac{\delta}{\delta-a\varepsilon}$$

$$- \frac{m}{4\pi(1+K)}\int_0^1 \frac{p(x)dx}{\ell-x} + \sqrt{\frac{\ell-x_o}{x_o}}\left\{\beta - \frac{(1-m)C_L}{2\pi(1+K)\ell}\,\frac{(2a^2+3)\varepsilon+a\delta}{\delta-a\varepsilon} -\right.$$

$$\left. - \frac{m}{2\pi(1+K)\ell}\int_0^1 \sqrt{\frac{\ell-x}{x}}\,p(x)dx\right\} + \frac{m}{x_o}\,\frac{G(x_o,a;p)}{2\pi(1+K)} \quad . \tag{32}$$

In Equations (31) and (32) the parameter E has been eliminated by using Eq. (22). The same step could also have been taken in order to eliminate

E from Equation (30). Equations (30), (31) and (32), when combined with Equations (17), (20), (21) and (22), provide a determinate system.

<u>The Sequence of Calculations</u>

The preceding formulae permit the determination of all unknowns for a profile design. This determination can be shown to depend solely on the cavity length parameter, a, by means of a tedious process which eliminates the other unknowns and results in a nonlinear equation defining a. In an important step in deriving this key result, one eliminates α from the system of equations by subtracting Equation (32) from Equation (31). Then Equations (17), (20), (21) and (22) can be used to reduce this equation to one involving only the unknowns m and a. Operating with these first four equations on Equation (30), one can reduce it to a second equation involving m and α. Fortunately, m can be separated out as a linear factor in the combined equations resulting from the difference of (32) and (31). The reduced form of Equation (30) can be factored in the same way. One then eliminates the quantity m by dividing one of these equations by the other in order to obtain a single nonlinear equation with the only unknown being the cavity-length parameter a. The resulting expression is:

$$[(1 - \frac{\mu}{x_o})T - (a - \sqrt{\frac{\ell - x_o}{x_o}})\beta - \frac{C_L}{\pi(1+K)} \left\{ \frac{4a^2\ell\sqrt{a}}{\delta - a\varepsilon} (F_1(1,a) - \frac{F_1(x_o,a)}{x_o}) \right.$$

$$+ [a - \sqrt{\frac{\ell - x_o}{x_o}} - \ell(\tan^{-1}\frac{1}{a} - \frac{1}{x_o}\tan^{-1}\sqrt{\frac{x_o}{\ell - x_o}})] \frac{\varepsilon + a\delta}{2\ell(\delta - a\varepsilon)}$$

$$- \left(a - \sqrt{\frac{\ell - x_o}{x_o}}\right) \frac{(2a^2+3)\varepsilon + a\delta}{2\ell(\delta - a\varepsilon)}\Bigg\}]H_\eta = [T - 2a\beta + \frac{C_L}{\pi(1+K)}\Bigg\{- \frac{4a^2\ell\sqrt{a}}{\delta - a\varepsilon} F_1(1,a)$$

$$+ \frac{a}{\ell}\frac{(2a^2+3)\varepsilon + a\ell}{\delta - a\varepsilon} - \left(a - \ell \tan^{-1}\frac{1}{a}\right)\frac{\varepsilon + a\delta}{\ell(\delta - a\varepsilon)}\Bigg\}] H_T \quad , \qquad (33)$$

where

$$H_\eta = C_L \left[\frac{4a^2\ell\sqrt{a}}{\delta - a\varepsilon} F_1(1,a) + \left(a - \ell \tan^{-1}\frac{1}{a}\right)\frac{\varepsilon + a\delta}{\ell(\delta - a\varepsilon)} - \frac{a}{\ell}\frac{(2a^3+3)\varepsilon + a\delta}{\delta - a\varepsilon}\right]$$

$$- \frac{1}{2\ell}\left(a - \ell \tan^{-1}\frac{1}{a}\right)\int_0^1 \frac{(\ell - 2x)p(x)}{\sqrt{x(\ell - x)}}dx + \frac{a}{\ell}\int_0^1 \sqrt{\frac{\ell - x}{x}}\, p(x)dx$$

$$- \frac{1}{2}\left(a + \ell \tan^{-1}\frac{1}{a}\right)\int_0^1 \frac{p(x)dx}{\sqrt{x(\ell - x)}} + \tan^{-1}\frac{1}{a}\int_0^1 p(x)\sqrt{\frac{x}{\ell - x}}\, dx$$

$$+ \frac{1}{2}\int_0^1 p(x)\, \ell n \left|\frac{a\sqrt{x} + \sqrt{\ell - x}}{a\sqrt{x} - \sqrt{\ell - x}}\right| dx \quad , \qquad (34)$$

$$H_T = C_L \left[\frac{4a^2\ell\sqrt{a}}{\delta - a\varepsilon}\left(F_1(1,a) - \frac{F_1(x_o,a)}{x_o}\right) - \left(a - \sqrt{\frac{\ell - x_o}{x_o}}\right)\frac{\varepsilon}{\delta - a\varepsilon} - \left(\tan^{-1}\frac{1}{a}\right.\right.$$

$$\left.\left. - \frac{1}{x_o}\tan^{-1}\sqrt{\frac{x_o}{\ell - x_o}}\right)\frac{\varepsilon + a\delta}{2(\delta - a\varepsilon)}\right] - \frac{1}{2}\left(G(1,a;p) - \frac{G(x_o,a;p)}{x_o}\right) - \left[a - \sqrt{\frac{\ell - x_o}{x_o}}\right.$$

$$\left. - \ell\left(\tan^{-1}\frac{1}{a} - \frac{1}{x_o}\tan^{-1}\sqrt{\frac{x_o}{\ell - x_o}}\right)\right]\frac{1}{4\ell}\int_0^1 \frac{\ell - 2x}{\sqrt{x(\ell - x)}}\, p(x)dx + \frac{1}{2\ell}\left[a\right.$$

$$\left. - \sqrt{\frac{\ell - x_o}{x_o}}\right]\int_0^1 \sqrt{\frac{\ell - x}{x}}\, p(x)dx \quad , \qquad (35)$$

and where the functions F_1 and G are defined by Equations (26) and (27). The known quantities in Equation (33) are K, C_L, T, μ, x_o and p(x). The unknown quantity is $\ell=a^2+1$. The value of a can be found by trial and error for each set of known quantities.

We can also introduce the additional notation

$$F_\eta = T - 2a\beta - \frac{C_L}{\pi(1+K)}\left[\frac{4a^2\ell\sqrt{a}}{(\delta-a\varepsilon)}F_1(1,a) + (a - \ell\tan^{-1}\frac{1}{a})\frac{\varepsilon+a\delta}{\ell(\delta-a\varepsilon)} - \frac{a}{\ell}\frac{(2a^2+3)\varepsilon+a\delta}{(\delta-a\varepsilon)}\right] , \tag{34a}$$

in order to write the simultaneous conditions $\eta(1)=0$ and $y(1)=T$ from Equations (30) and (31) as

$$F_\eta = \frac{-m}{\pi(1+K)} H_\eta \quad .$$

Similarly, we can introduce the expression

$$F_T = (1 - \frac{\mu}{x_o})T - \beta(a - \sqrt{\frac{\ell-x_o}{x_o}}) - \frac{C_L}{\pi(1+K)}\left\{\frac{4a^2\ell\sqrt{a}}{\delta-a\varepsilon}[F_1(1,a) - \frac{F_1(x_o,a)}{x_o}] + [a - \sqrt{\frac{\ell-x_o}{x_o}} - \ell(\tan^{-1}\frac{1}{a} - \frac{1}{x_o}\tan^{-1}\sqrt{\frac{x_o}{\ell-x_o}})]\frac{\varepsilon+a\delta}{2\ell(\delta-a\varepsilon)} - \frac{(2a^2+3)\varepsilon+a\delta}{2\ell(\delta-a\varepsilon)}(a - \sqrt{\frac{\ell-x_o}{x_o}})\right\} , \tag{35a}$$

and write the simultaneous conditions $y(x_o) = \mu T$ and $y(1) = T$ from Equations (31) and (32) as

$$F_T = \frac{-m}{\pi(1+K)} H_T \quad .$$

Then in accordance with the discussion at the start of this section, we can divide these two expressions in order to eliminate m and write Equation (33) in abreviated form as

$$f(a) = F_T H_\eta - F_\eta H_T = 0 \quad . \tag{33a}$$

Once the solution of Equation (33) has been found, we can solve for m from the condition following Equation (35):

$$m = - \frac{\pi(1+K)}{H_\eta} F_\eta \quad . \tag{36}$$

Then in accordance with Equation (17), we can find A from

$$A = - \frac{2(1-m)C_L}{\pi(1+K)} \frac{\sqrt{a}}{\delta - a\varepsilon} \quad .$$

The design attack angle follows from

$$\begin{aligned}
\alpha = a\beta &+ \frac{(1-m)C_L}{\pi(1+K)} \left\{ \frac{\delta}{\delta - a\varepsilon} + \frac{1}{2\ell} \left(a - \ell \tan^{-1}\frac{1}{a}\right) \frac{\varepsilon + a\delta}{\delta - a\varepsilon} - \frac{a}{2\ell} \frac{(2a^2+3)\varepsilon + a\delta}{\delta - a\varepsilon} \right\} \\
&+ \frac{m}{2\pi(1+K)} \left\{ - \frac{a}{\ell} \int_0^1 \sqrt{\frac{\ell - x}{x}}\, p(x)dx + \frac{1}{2\ell}\left(a - \ell \tan^{-1}\frac{1}{a}\right) \int_0^1 \frac{\ell - 2x}{\sqrt{x(\ell - x)}}\, p(x)dx \right. \\
&- \frac{C_L}{2} \ln \frac{\ell}{a^2} + \frac{1}{2}\left(a + \ell \tan^{-1}\frac{1}{a}\right) \int_0^1 \frac{p(x)dx}{\sqrt{x(\ell - x)}} - \tan^{-1}\frac{1}{a} \int_0^1 p(x) \sqrt{\frac{x}{\ell - x}}\, dx \\
&\left. + \int_0^1 p(x) \ln\left(1 - \frac{1}{a}\sqrt{\frac{\ell - x}{x}}\right) dx \right\} \quad .
\end{aligned} \tag{37}$$

After we have calculated m, α and A, we can calculate the remaining parameters in accordance with

$$B = -\frac{A}{4}\frac{\varepsilon+a\delta}{a\ell\sqrt{a}} + \frac{m}{4\pi(1+K)a\ell}\int_0^1 \frac{(\ell-2x)}{\sqrt{x(\ell-x)}}\,p(x)dx \quad , \tag{38}$$

$$D = \alpha - C_o = -\frac{A}{2}\frac{\delta}{\sqrt{a}} - \frac{B}{2} + \frac{m}{4\pi(1+K)}\int_0^1 \frac{p(x)}{\ell-x}\,dx \tag{39}$$

and for $E = y_c(1)/a$ we have

$$E = \beta - \frac{(1-m)C_L}{2\pi(1+K)}\frac{(2a^2+3)\varepsilon+a\delta}{\ell(\delta-a\varepsilon)} - \frac{m}{2\pi(1+K)\ell}\int_0^1 \sqrt{\frac{\ell-x}{x}}\,p(x)dx \quad . \tag{40}$$

The hydrodynamic force coefficients C_D and C_m follow from

$$C_D = 2\pi(1+K)\ell\left(aB + \frac{E}{2}\right)^2 = \frac{\ell}{2\pi(1+K)}\left\{\frac{(1-m)C_L}{\ell}\frac{\varepsilon+a\delta}{\delta-a\varepsilon} + \frac{m}{2\ell}\int_0^1 \frac{\ell-2x}{\sqrt{x(\ell-x)}}\,p(x)dx + \pi(1+K)E\right\}^2 \quad , \tag{41}$$

and

$$C_m = -(1-m)C_L\,\frac{(3+a^2)\delta - 2a(2+a^2)\varepsilon}{8\varepsilon\sqrt{\ell}} - m\int_0^1 xp(x)dx \quad . \tag{42}$$

The wetted surface contour, $\eta(x)$, and the shape of the upper surface of the cavity, $y(x)$, follow from Equations (24) and (25) respectively. In addition, the slope of the wetted surface is

$$\frac{d\eta}{dx} = \alpha - \frac{B}{2}\left(1 - 2a\sqrt{\frac{x}{\ell-x}}\right) - D - \frac{E}{2}\,\frac{\ell-2x}{\sqrt{x(\ell-x)}} + \frac{m}{2\pi(1+K)}\left\{\frac{1}{2}\int_0^1 \frac{p(t)dt}{\ell-t}\right.$$

$$- \frac{1}{2}\sqrt{\frac{\ell-x}{x}}\int_0^1 \frac{p(t)dt}{\sqrt{t(\ell-t)}} + \frac{1}{2\sqrt{x(\ell-x)}}\int_0^1 p(t)\sqrt{\frac{t}{\ell-t}}\,dt + \frac{C_L\, x}{2(\ell-x)}$$

$$\left. + \frac{\ell}{2\sqrt{x}(\ell-x)^{3/2}}\, P\int_0^1 \frac{p(t)dt}{\sqrt{\frac{t}{\ell-t}} - \sqrt{\frac{x}{\ell-x}}}\right\}, \tag{43}$$

where P denotes the Cauchy principal value of the integral so designated. This result is required for off-design calculations of profile performance. For reference, one can also tabulate the perturbation pressure on the wetted surface. This pressure is the sum of the prescribed pressure m p(x) and the pressure $\overline{p}(x)$ which is due to the nose singularity. This latter pressure is obtained from those terms involving A in Equation (13) when $\zeta=e^{i\theta}$ or when $z=xe^{2\pi i}$. The expression for $\overline{p}(x)$ is

$$\overline{p}(x) = \begin{cases} \dfrac{4(1-m)C_L}{\pi(\delta-a\varepsilon)}\;\dfrac{\sqrt{\ell-x} - a\sqrt{x}}{\sqrt{x}}, & K>0 \\[2ex] \dfrac{4(1-m)C_L}{\pi}\;\dfrac{1-\sqrt{x}}{\sqrt{x}}, & K=0, \end{cases}$$

where the second form for $\overline{p}(x)$ is simply the limit of the first as $K\to 0$ and as $a\to\infty$. Then the total pressure is $\overline{p}(x) + mp(x)$.

Formulae for Profile Design at Zero Cavitation Number

The results appropriate for this special case can be obtained directly from the preceding formulae by taking the limits $K \to 0$ and $\ell \to \infty$. The simplifications introduced by this step indicate that when K=0, all numerical work should be based upon these specific formulae.

For example, it can be seen from Equation (20) that $B \to 0$ as $K \to 0$, and since $a \to \infty$ in this case no iterative solution such as that associated with (33) or (33a) is needed. Therefore we can proceed at once to the calculation of m:

$$m = \frac{2C_L\, J(x_o) - \pi[1 + 1/\sqrt{x_o} - 2\mu/x_o]T}{2\, C_L J(x_o) + \frac{1}{2}(\frac{1}{\sqrt{x_o}} - 1)\int_0^1 p(x)\, \ell n\, \frac{1+\sqrt{x}}{1-\sqrt{x}}\, dx + \int_0^1 p(x)\, [\ell n(1+\frac{1}{\sqrt{x}}) - \frac{1}{x_o}\, \ell n(1+\sqrt{x_o/x})]dx} \tag{44}$$

where

$$J(x_o) = \frac{1}{2}(1 + \frac{1}{\sqrt{x_o}})[3\sqrt{2} - \ell n(1 + \sqrt{2})] + \frac{1}{x_o}\, \ell n(x_o^{1/4} + \sqrt{1 + \sqrt{x_o}})$$
$$- (1 + 2\sqrt{x_o})\, \sqrt{1 + \sqrt{x_o}} \Big/ x_o^{3/4} \quad . \tag{45}$$

Then we can find the design attack angle from

$$\alpha = y_c(1) + \frac{2(1-m)}{\pi}\, C_L + \frac{m}{2\pi}\left\{\int_0^1 \frac{p(x)dx}{\sqrt{x}} + \int_0^1 p(x)\, \ell n\, \left|1 - \frac{1}{\sqrt{x}}\right| dx\right\} \quad . \tag{46}$$

We have noted above that $a \to \infty$ as $K \to 0$. This fact requires that we return to the meaning of the coefficient E in terms of its contribution to the cavity thickness, T=y(1). As we have seen in Equation (25), the contribution of

the point drag singularity is $E\sqrt{x(\ell-x)} = aE$ at $x=1$. If we denote this contribution to T by the designation $y_c(1)$, we can write $E=y_c(1)/a$. That is, recognizing that $y_c(1)$ will be bounded as $K\to 0$, we require that $E=O(1/a)$ in this limit. We note that this finding is consistant with the result which can be deduced from Equation (22), for example. Now if we replace E by $y_c(1)/a$ in Equation (25) and let $a\to\infty$ and $x=1$ so that $y(1)=T$ we get

$$y_c(1) = \frac{T}{2} - \frac{(1-m)C_L}{2\pi}\,[3\sqrt{2} - \ell n(1 + \sqrt{2})] - \frac{m}{2\pi}\left\{\int_0^1 \frac{p(x)dx}{\sqrt{x}} - \frac{1}{2}\int_0^1 p(x)\ \ell n\,\frac{1+\sqrt{x}}{1-\sqrt{x}}\,dx\right\} . \tag{47}$$

Also in this case, we see that

$$A = -\frac{2(1-m)C_L}{\pi} \quad . \tag{48}$$

Then we can write

$$\eta(x) = (\alpha - \frac{2(1-m)C_L}{\pi})x - \frac{m}{2\pi}\{\sqrt{x}\int_0^1 \frac{p(x)dx}{\sqrt{x}} + \int_0^1 p(t)\ \ell n\left|1 - \sqrt{x/t}\right|dt\} - y_c(1)\sqrt{x} \tag{49}$$

and

$$y(x) = \alpha x + \frac{(1-m)C_L}{\pi}\{(1+2\sqrt{x})x^{1/4}\sqrt{1+\sqrt{x}} - 2x - \ell n(x^{1/4} + \sqrt{1+\sqrt{x}})\}$$

$$+ y_c(1)\sqrt{x} + \frac{m}{2\pi}\{\sqrt{x}\int_0^1 \frac{p(x)dx}{\sqrt{x}} - \int_0^1 p(t)\ \ell n\ (1 + \sqrt{x/t})dt\} \quad . \tag{50}$$

The hydrodynamic coefficients C_D and C_m become

$$C_D = \frac{1}{2\pi}\{2(1-m)C_L + \frac{m}{2}\int_0^1 \frac{p(x)}{\sqrt{x}}\,dx + \pi y_c(1)\}^2 \tag{51}$$

and

$$C_m = -\frac{5}{16}(1-m)C_L - m\int_0^1 x\, p(x)dx \quad . \tag{52}$$

Note also that the slope of the wetted surface is

$$\eta'(x) = \alpha - \frac{2(1-m)}{\pi} C_L - \frac{y_c(1)}{2\sqrt{x}} + \frac{m}{4\pi\sqrt{x}}\left\{ P\int_0^1 \frac{p(t)dt}{\sqrt{t}-\sqrt{x}} - \int_0^1 \frac{p(x)dx}{\sqrt{x}} \right\} \quad . \tag{53}$$

Preliminary Analyses

The analyses of the preceding two sections have been formulated with the thought that one specifies the design pressure distribution, $p(x)$, the cavitation number, K, the cavity thickness at the trailing edge, T, and the design lift coefficient, C_L. He also prescribes the cavity thickness, μT, at the chord location, x_o. The computation sequence outlined above then produces the cavity length, ℓ, the wetted surface shape of the hydrofoil, $\eta(x)$, the upper contour of the cavity, $y(x)$, the design attack angle, α, and the hydrodynamic performance parameters C_m, C_D and L/D.

However, one is not able to specify the parameter μ with complete arbitrariness. This situation arises as long as one insists that the pressure on the wetted surface is greater than the cavity pressure except at the trailing edge, and possibly at the nose. The wetted surface pressure will certainly be positive if the parameters $y_c(1)$ and m satisfy the conditions

$$\left.\begin{aligned} &y_c(1) \geq 0 \quad , \\ &0 \leq m \leq 1 \quad . \end{aligned}\right\} \tag{54}$$

Depending upon the specific values of C_L, T, K, x_o and the nature of p(x), the added constraints specified by (54) indicate that permissible values of μ will lie in restricted ranges. Therefore as a prelude to the execution of any profile design, the designer needs to have some knowledge of the permissible range of μ values which he can specify. The purpose of this paragraph is to explore this matter in detail sufficient for us to continue our study of the third design procedure.

The basic nature of the constraints noted above is probably most conveniently illustrated when K=0. Then we can determine the relationships between C_L, T, $y_c(1)$, m, x_o and μ quite simply. In fact the basic equations needed to carry out this investigation are given by Equations (47) and (50), with the latter of these being written for the particular case in which $y(x_o)=\mu T$. Equation (46) is used to eliminate α from the final expression. As a result we find that

$$\frac{y_c(1)}{T} = \frac{1}{2}\left\{1 - \frac{C_L}{T}\left[(1-m)\,\frac{3\sqrt{2} - \ln(1+\sqrt{2})}{\pi} - \frac{m}{\pi C_L}\left(\int_0^1 \frac{p(x)dx}{\sqrt{x}} - \frac{1}{2}\int_0^1 p(x)\,\ln\frac{1+\sqrt{x}}{1-\sqrt{x}}\,dx\right)\right]\right\} \tag{55}$$

and

$$\mu = x_o + (\sqrt{x_o}-x_o)\frac{y_c(1)}{T} + \frac{C_L}{T}\left[\frac{1-m}{\pi}\{(1+2\sqrt{x_o})\sqrt{x_o+\sqrt{x_o}} - x_o[3\sqrt{2}-\ln(1+\sqrt{2})] - \ln(x_o^{1/4} + \sqrt{1+\sqrt{x_o}})\} + \frac{m}{2\pi C_L}\{(\sqrt{x_o}-x_o)\int_0^1 \frac{p(x)dx}{\sqrt{x}} - \int_0^1 p(x) \times [\ln(1 + \sqrt{\frac{x_o}{x}}) - x_o \ln(1 + \frac{1}{\sqrt{x}})]dx\}\right] \quad . \tag{56}$$

Thus when K=0, we can prescribe values of m, $\frac{C_L}{T}$ and x_o and determine corresponding values of $y_c(1)/T$ and μ.

Rectangular Pressure Distributions

In order to continue the analysis we can introduce a specific pressure distribution into Eqs. (55) and (56). For our purposes, it is particularly convenient to study pressure distributions of rectangular shape. We will specify these by the following equations:

(a) for $0<s\leq 1/2$,

$$p(x) = \begin{cases} C_L/2s & , \quad 0\leq x\leq 2s \\ 0 & , \quad 2s<x\leq 1 \end{cases}$$

(b) for $1/2\leq s<1$,

$$p(x) = \begin{cases} 0 & , \quad 0\leq x\leq (2s-1) \quad , \\ C_L/2(1-s) & , \quad (2s-1)\leq x\leq 1 \quad . \end{cases}$$

These equations specify a series of nose-loaded or tail-loaded profiles, depending upon the value of s selected, as illustrated in the diagrams of Figure 4. When s=1/2, the profile is uniformly loaded over the entire chord. The contribution of the prescribed pressure distribution to the design lift coefficient is mC_L. This form of the prescribed pressure distribution also illustrates the general nature of the function p(x) which can always be written as

$$p(x) = C_L \, f(x) \quad .$$

Thus we see that the integrals have integrands which depend on the "normalized" pressure, f(x), which is defined to satisfy the condition

$$\int_0^1 f(x)\,dx = 1 \quad .$$

As a result, the step of factoring the quantity C_L from Equations (55) and (56), or more generally in any of the equations of the section on "The Sequence of Calculations," leads to no difficulties.

When rectangular pressure distributions are used in Equations (55) and (56), they reduce to

$$\frac{y_c(1)}{T} = \frac{1}{2}\left[1 - \frac{C_L}{T} D(m,s)\right] \tag{57}$$

and

$$\mu = x_o + (\sqrt{x_o} - x_o)\,\frac{y_c(1)}{T} + \frac{C_L}{T}\{(1-m)\,F(x_o) + mg(x_o,s)\} \quad , \tag{58}$$

where

$$D(m,s) = (1-m)\,\frac{3\sqrt{2} - \ln(1+\sqrt{2})}{\pi} + \frac{m}{\pi}\begin{cases} \dfrac{1}{\sqrt{2s}} + \dfrac{1-2s}{4s}\,\ln\dfrac{1+\sqrt{2s}}{1-\sqrt{2s}} \;, & 0<s\leq\dfrac{1}{2} \;, \\[2ex] \dfrac{1}{1+\sqrt{2s-1}} - \dfrac{1}{2}\,\ln\dfrac{1+\sqrt{2s-1}}{1-\sqrt{2s-1}} \;, & \dfrac{1}{2}\leq s<1 \;, \end{cases}$$

$$F(x_o) = \frac{1}{\pi}\{(1+2\sqrt{x_o})\sqrt{x_o+\sqrt{x_o}} - x_o[3\sqrt{2} - \ln(1+\sqrt{2})] - \ln(x_o^{1/4} + \sqrt{1+\sqrt{x_o}})\} \quad .$$

Moreover for $0<s\leq 1/2$ we have

$$g(x_o,s) = (\frac{x_o}{2\pi}) \left[\frac{1}{\sqrt{2s}} (\frac{1}{\sqrt{x_o}} - 1) + \frac{2s-1}{2s} \ln (1+\sqrt{2s}) - \frac{2s-x_o}{2s\, x_o} \ln(1 + \sqrt{2s/x_o}) + \frac{1}{2x_o} \ln \frac{2s}{x_o} - \frac{1}{2} \ln(2s) \right]$$

and for $1/2<x\leq 1$ we have

$$g(x_o,s) = (\frac{x_o}{2\pi}) \left[\frac{1}{1+\sqrt{2s-1}} (\frac{1}{\sqrt{x_o}} - 1) + \ln (1+\sqrt{2s-1}) + \frac{2s-1}{4(1-s)} \ln(2s-1) - \frac{1}{2(1-s)} \times (\frac{1}{x_o} - 1) \ln(1 + \frac{1}{\sqrt{x_o}}) + \frac{1}{4x_o(1-s)} \ln \frac{1}{x_o} + \frac{2s-1-x_o}{2x_o(1-s)} \ln (1 + \sqrt{\frac{2s-1}{x_o}}) - \frac{2s-1}{4x_o(1-s)} \ln \frac{2s-1}{x_o} \right] ,$$

These closed-form expressions can be evaluated in accordance with the discussion following Equations (55) and (56). In order to determine a range of possible μ values for prescribed values of C_L/T, s and x_o, it is sufficient for us to evaluate Equations (57) and (58) for m=0 and m=1. In the course of these evaluations, we must be certain that $y_c(1)\geq 0$ is satisfied.

In this context, we note that Equation (57) shows for a fixed positive value of D, corresponding to prescribed values of s and m, that $y_c(1)/T$ decreases as C_L/T increases. Thus the greatest allowable value of C_L/T is limited by the condition $y_c(1)/T=0$ in accordance with Equation (54). These limiting values of C_L/T can be calculated for a range of m and s by finding the reciprocal of D(s,m). Results of such calculations are plotted in Figure 5. It may be recalled that when $y_c(1)=0$ and $m<1$, the second design procedure

is being employed and that in this circumstance, occasions were found [4] for which no solution could be obtained. This situation was attributed to the fact that C_L and T could not be prescribed with complete independence. The curves of Figure 5 show more quantitatively the nature of the limiting relationship between C_L and T which had only been described qualitatively in Reference 4. Moreover, when m=1, the shockless entry condition prevails and a limiting form of the first design procedure applies because $y_c(1)=0$ also. The condition $y_c(1)\neq 0$ shows that the first design procedure also has a limit for permissible values of the ratio C_L/T. The range of parameters used in the first procedure did not exceed $C_L/T=.15$, in Reference 3. Evidently, this range was not broad enough to encounter the limit illustrated in Figure 5. Further, Figure 5 shows that the first design procedure permits a broader range of C_L/T values than can be used for the second design procedure. We notice also that the influence of peak pressure location is greatest in the case when m=1. When m=0, the values of s have no effect on the permissible range of C_L/T. However, aside from the case of m=0, we see that the designer will have more latitude with respect to C_L/T values for tail-loaded profiles than for nose-loaded hydrofoils. In any event, the design values of C_L/T must be selected to be less than those shown in Figure 5 for the various rectangular pressure distributions. In terms of the third design method, values of C_L/T must be in the region of C_L/T vs s of Figure 5 which is bounded by the curve m=1 and the C_L/T axis. For then, as we see from Equation (57), $0\leq y_c(1)/T\leq 1/2$ and Equations (54) will certainly be satisfied. We note also that the m=1 curve has an asymptote at x=.659 indicating for tail-loaded profiles that we can often choose C_L/T to be as large as we please provided we are willing to move in the direction of shockless entry (m=1). Notice also that these results are completely independent of the values of x_o or μ.

Having surveyed various limitations on the specification of the design point, we now turn to the influence of these factors on permissible values of μ. As noted above, for prescribed values of C_L/T, s and x_o, it will suffice if we consider the two limiting cases m=0 and m=1 provided only that $y_c(1)\geq 0$. First let us consider the case m=0 which corresponds to the flat plate profile with a point-drag singularity at an attack angle,

$$\alpha = y_c(1) + 2C_L/\pi \quad ,$$

as can be seen from Equation (46). Clearly, the values of μ are independent of any prescribed pressure distribution and therefore of the parameter s. The results of calculations from Equations (57) and (58) for three values of x_o are plotted in Figure 6. The locus of points for which $y_c(1)=0$ is shown as the dashed vertical line in this figure. Only values of C_L/T to the left of this line are permissible.

When m=1, Equations (57) and (58) can be evaluated again with the results plotted as shown in Figure 7. The three values of x_o selected for these calculations are the same as those used in Figure 6. For each of these x_o values, curves for nine values of s are shown with the corresponding boundary for $y_c(1)=0$ shown as a dotted line intersecting the constant -s curves. For a prescribed value of s, only points to the left of the intersection give permissible μ and C_L/T values. Figure 7 also shows that the lines from each value of s converge to a common point on the μ-axis. The location of this point on the μ axis depends only on x_o. This ordinate is determined from Equations (54) and (55) when $C_L/T=0$. Thus,

$$\mu_o = (x_o + \sqrt{x_o})/2 \quad .$$

These focal points are also plotted on the μ axis in Figure 7.

The preceding trends, obtained from rectangular pressure distributions, have been considered chiefly because the analysis in these cases is greatly simplified and the exploration of basic theoretical trends and limitations is facilitated. On the other hand, comparison of these results at zero cavitation number with corresponding results for semi-elliptic pressure distributions [4] gives some indication of the effect of pressure-distribution shape on corresponding values of μ. This prescribed pressure distribution is illustrated for nose and tail loaded profiles in Figure 8 and its analytical description is

$$p(x) = \begin{cases} (h/s)\sqrt{x(2s-x)} \quad , \quad h=2C_L/\pi s \quad \text{for} \quad 0<s\leq 1/2 \quad , \\ [h/(1-s)]\sqrt{(1-x)(1-2s+x)} \quad , \quad h=2C_L/\pi(1-s) \quad \text{for} \quad 1/2\leq s<1 \quad . \end{cases} \tag{59}$$

Results obtained using this distribution are consistent with those of Reference 4.

Comparison of various quantities in Figure 8 with those of Figure 4 shows that the nomenclature for the rectangular and semielliptical pressure distributions has been made mutually consistent in order to facilitate comparisons of results from rectangular and semielliptical shapes. Figure 9 provides such a comparison at K=0 for values of the other parameters which are most sensitive to the details of p(x). These results were obtained numerically from Equations (55), (56) and (59) and from Equations (57) and (58). The curves labeled $C_L/T=2$ and m=1 show the variation to be expected in μ resulting from these two pressure distributions when $x_o=.1$. For example, when s=.2 these curves show a difference in μ of about 10%. For more rearward locations of the peak pressure, the difference in

the two values of μ is seen to decrease and to change sign for tail loaded sections. The line for $C_L/T=0$ shows μ values which are independent of pressure distribution shape. Thus we expect variations in μ caused by shaping of the prescribed pressure to decrease with decreasing C_L/T and with decreasing m.

A second comparison of the effect of pressure distribution shape is shown by Figure 10. In this figure, limiting values of C_L/T are compared for semi-elliptic and rectangular pressure distributions. Again, only the value of m=1 is considered in order to emphasize differences which arise due to the shaping of otherwise similar pressure distributions. The curve labeled "rectangular" is simply the curve from Figure 5 for m=1. The curve labeled "elliptic" was obtained numerically from Equations (47) and (59) with m=1 and $y_c(1)=0$. The asymptote for the rectangular distribution is at s=.659. The asymptote for the semi-elliptic case was not determined. However, we believe that the asymptotic value of s lies slightly to the right of the value for the rectangular case because the two curves cross at a high value of C_L/T which is off the graph. We also believe that the asymptotic value of s will be less than s=.7. The important point illustrated by Figure 10 is that the shape of p(x) affects the permissible C_L/T range within which the constraints of Equations (54) can be satisfied. Taken together, Figures (9) and (10) suggest that there are two factors which one needs to consider when laying down profile design specifications. The more important of these is the chordwise center of pressure location for the prescribed distribution. We take this view because at m=1.0, shockless entry exists and the value of s is the center of pressure location for both rectangular and semi-elliptic shapes. The less important factor is that details of the pressure distribution shape will also affect the range of parameters

for which one can expect to obtain satisfactory profile designs. But this effect is seen to be considerably less pronounced than the primary influence of center of pressure location although it can lead to some uncertainty in the initial formulation of design specifications.

Data for Semi-Elliptic Pressure Distributions

The foregoing considerations show that the designer must accept certain constraints in the specification of the design parameters C_L/T, μ, x_o, K and p(x). Moreover, he can not be expected to arrive at a consistant set of specifications without some knowledge of the way these factors interact. In order to arm him with such knowledge, we present in this subsection a series of graphs which apply strictly to the semi-elliptic pressure distribution but which can also be used as a qualitative guide for other distributions. Unfortunately it will be expedient for us to restrict ourselves to the case of zero cavitation number. However, since foil design at K=0 is of considerable practical interest, these limited results are worth presenting. The reasons for restricting these data to zero cavitation number can be seen from the form of the general equations when the cavitation number is greater than zero.

For example, we can start the general calculations for consistant parameters with the formula for the determination of the limiting values of C_L/T. This result is obtained from the condition that y(1)=T as expressed by Equation (31) with the added condition that $y_c(1)=0$. Equation (30), which corresponds to the condition $\eta(1)=0$, is used to eliminate α from Equation (31). In order to show how the term $y_c(1)$ enters the resulting equation, we replace Equation (31), with Equation (30) used to eliminate α, and write

$$\frac{T}{2} - y_c(1) = \frac{C_L}{\pi(1+K)} \left\{ (1-m) \left[\frac{2a^2 \ell \sqrt{a}}{\delta - a\varepsilon} F_1(1,a) + (a - \ell \tan^{-1} \frac{1}{a}) \frac{\varepsilon + a\delta}{2\ell(\delta - a\varepsilon)} \right] \right.$$

$$+ m \left[\frac{1}{2\ell} \int_0^1 \frac{(\ell - 2x) f(x)}{\sqrt{x(\ell - x)}} dx + \frac{1}{2}(a + \ell \tan^{-1} \frac{1}{a}) \int_0^1 \frac{f(x)dx}{\sqrt{x(\ell - x)}} \right.$$

$$\left. \left. - \tan^{-1} \frac{1}{a} \int_0^1 f(x) \sqrt{\frac{x}{\ell - x}} dx - \int_0^1 f(x) \ell n \left| \frac{a\sqrt{x} + \sqrt{\ell - x}}{a\sqrt{x} - \sqrt{\ell - x}} \right| dx \right] \right\} \quad . \qquad (60)$$

Once the cavity length parameter, a, has been determined and $y_c(1)$ set equal to zero, the limiting value of C_L/T can be determined from Equation (60) for values of m in the range, $0 \leq m \leq 1$. Note again that the pressure distribution p(x) can be written in the form

$$p(x) = C_L \, f(x) \quad ,$$

where the function f is required to satisfy

$$\int_0^1 f(x)dx = 1 \quad .$$

The last integral is made equal to unity simply by scaling all ordinates of f uniformly if the integral should be found to differ from one. Therefore the three integrals in (60) depend only on f(x), the shape of p(x), and not explicitly upon the value of C_L because this factor can now be factored out of the right hand side of Equation (60) as shown.

Before we can caluclate the limiting value of C_L, we must find the cavity length parameter a for prescribed values of m and K. This can be done if we put $aE = y_c(1) = 0$ in Equation (40). For then we have

$$\beta = 1 - \frac{1}{\sqrt{1+K}} = \frac{C_L}{2\pi(1+K)} \left\{ (1-m) \frac{(2a^2+3)\varepsilon + a\delta}{\ell(\delta - a\varepsilon)} + \frac{m}{\ell} \int_0^1 \sqrt{\frac{\ell - x}{x}}\, f(x)dx \right\} . \quad (40a)$$

This equation can be used to eliminate C_L from Equation (60) after we put $y_c(1)=0$. Then we have

$$2\frac{\beta}{T}\left\{(1-m)\left[\frac{2a^2\ell\sqrt{a}}{\delta - a\varepsilon} F_1(1,a) + (a - \ell \tan^{-1}\frac{1}{a}) \frac{\varepsilon + a\delta}{2\ell(\delta - a\varepsilon)}\right] + m\left[\frac{1}{2\ell}\int_0^1 \frac{(\ell - 2x)f(x)}{\sqrt{x(\ell - x)}} dx\right.\right.$$

$$+ \frac{1}{2}(a + \ell \tan^{-1}\frac{1}{a}) \int_0^1 \frac{f(x)dx}{\sqrt{x(\ell - x)}} - \tan^{-1}\frac{1}{a}\int_0^1 f(x)\sqrt{\frac{x}{\ell - x}}\, dx$$

$$\left.\left. - \int_0^1 f(x)\, \ell n \left|\frac{\sqrt{\ell - x} + a\sqrt{x}}{\sqrt{\ell - x} - a\sqrt{x}}\right| dx\right]\right\} = (1-m)\frac{(2a^3+3)\varepsilon + a\delta}{\ell(\delta - a\varepsilon)} + \frac{m}{\ell}\int_0^1 \sqrt{\frac{\ell - x}{x}}\, f(x)dx \quad . \quad (61)$$

Since m, $\beta(K)$ and T are specified, the cavity length parameter a is the only unknown in Equation (61). Equation (61) can now be solved for the parameter a by iteration. Once values of a have been found for m=0 and m=1, say, Equation (60) can be used to determine limiting values of C_L/T, corresponding to these two limiting values of m.

Having found the limiting values of C_L/T for prescribed values of m and β/T, one can now turn to the calculation of μ for various values of m, β/T and for values of C_L/T less than or equal to the limiting values. The first task requires that we determine the value of a when m, β/T and C_L/T are specified and the normalized pressure distribution f(x) is given. This determination requires that we solve Equation (36) by trial and error. Once appropriate values of a have been found, Equation (32) can be used to solve directly for μ.

By proceeding in the manner described above, one can calculate limiting values of C_L and consistant values of μ for various values of C_L, T, K, m

and x_o. Having the limiting values of C_L enables one to be certain that $y_c(1)\geq 0$. However it is apparent from Equation (36) that although the quantities C_L/T, β/T and m are involved, the quantity $1+K=(1-\beta)^{-2}$ also appears. Evidently it is not possible to reduce the problem to one involving C_L/T, β/T and μ as primary variables except for the special case of $K=\beta=0$. In this special case we have already seen that C_L/T and μ serve as useful parameters for the correlation of consistant values of m, x_o and characteristics of the pressure distribution shape. Therefore we will give further examples of permissible ranges of μ for K=0 because this is a practically important case and because the trends displayed will have qualitative value for the interpretation of results at other values of K.

For the case of K=0, we can use the special formulae of Equations (55) and (56), with Equation (59) for p(x), to calculate the set of consistant values which satisfy Equations (54). The first set of results is shown in Figure 11 which gives the limiting values of C_L/T for m=1 and m=0 for values of s between .1 and .5. These values of s are more than sufficient to cover the practically useful range of C_L/T. Figure 12 shows values of μ for $y_c(1)\geq 0$ for three values of x_o when m=0 and K=0. Figures 13, 14 and 15 show consistant values of μ when K=0 and m=1 for the three values of x_o given in Figure 12. In these three figures, it is also necessary to show the effect of the peak pressure location s. As we have seen already, there is no dependence on s when m=0. In all of these figures the values of $y_c(1)=0$ for each C_L/T correspond to those shown in Figure 11.

It is found by comparing Figure 12 data with those from Figures 13, 14 and 15 that there is only one permissible value of μ for all values of

m in the range $0 \leq m \leq 1$ when s is close to .2. If s is less than .2 the value of μ at $m=0$ is greater than that at $m=1$. On the other hand, if s exceeds .2, the value of μ at $m=0$ will be less than that for $m=1$. For any particular design-value of C_L/T the permissible range of μ will lie between the value for $m=0$ and the value determined by $m=1$ and the design value of s. We also note that the cut-off values of C_L/T for $y_c(1)=0$ differ when $m=0$ or $m=1$. This is illustrated in Figure 11 for the semi-elliptic pressure distribution and in Figure 5 for rectangular distributions. This fact means that these preliminary data for semi-elliptic distributions are not entirely complete even for the zero-cavitation number case. There will be cases in which the design value of C_L/T will require that the lowest permissible value for m ($=m'$, say) must be greater than zero. This simply means that the permissible values of m will now lie in the inteval $0<m' \leq m \leq 1$ if $y_c(1) \geq 0$. In spite of the uncertainty remaining in Figures 13, 14 and 15 regarding the value of μ corresponding to the lowest m-value for the design value of s, we can still start the calculation by the third design method using the data from Figures 12, 13, 14 and 15. If one finds that $y_c(1)<0$ for some value of μ which was thought to be permissible this case can be discarded in favor of a value of μ nearer to that for $m=1$.

Alternatively, one can assume that the design value of C_L is the limiting value. Then, when $y_c(1)=0$, Equation (55) shows that the necessary value of m can be determined by

$$m' = \frac{3\sqrt{2} - \ln(1+\sqrt{2}) - \pi T/C_L}{3\sqrt{2} - \ln(1+\sqrt{2}) + \int_0^1 \frac{f(x)dx}{\sqrt{x}} - \frac{1}{2}\int_0^1 f(x) \ln\frac{1+\sqrt{x}}{1-\sqrt{x}}\, dx} \qquad (55a)$$

We can then put m=m' in Equation (56), along with prescribed values of C_L, T and x_o in order to find the corresponding limiting value of μ. This value of μ and the value obtained for m=1 determine the admissible range of μ for the case when the design value of C_L lies between the two limiting values of C_L for $m \geq m' > 0$ and m=1.

The Design Procedure for Arbitrary Cavitaton Number

For nonzero cavitation numbers, it is not possible to present the kind of preliminary data as compactly as we did for K=0. The primary reason is that now both $\beta(K)$ and the quantity (1+K) appear in the equations. Therefore these input parameters together with other prescribed quantities which are C_L, x_o and T, in addition to the pressure function p(x), seem to make the task of reducing the number of governing parameters not too useful. Moreover, the selection of values for the several input quantities must always be such that the constraints,

$$\left.\begin{array}{l} 0 \leq m \leq 1 \\ \text{and} \\ y_c(1) \geq 0 \end{array}\right\} \tag{54}$$

are satisfied. For otherwise, our calculations could represent a physically unrealistic solution, as we have noted previously.

We have already seen in the case of K=0 when C_L and T are prescribed that the constraints of Equation (54) can lead to certain "cut-off" values for the parameter μ which correspond to m=0 and $y_c(1)=0$. In these examples the shape of the prescribed pressure distribution is represented by the single parameter s. For nonzero values of K, we will continue to use this parameter for purposes of preliminary analysis. However, we will now

abandon the use of the parameter C_L/T and simply treat μ, C_L, T, x_o and K as input quantities along with the value of s. Now we will envisage the constraints defined by Equations (54) as providing an admissible region in a C_L-μ plane. The extent of this region will depend on the values assigned to K, T, x_o and arbitrarily, it will encompass values of s between .1 and .9. The admissible region of the C_L-μ plane is determined by Equations (30), (31) and (32) which follow from

$$\eta(1) = 0 \quad ,$$

$$y(1) = T \quad ,$$

and

$$y(x_o) = \mu T \quad ,$$

respectively. The boundaries of this region are found from the constraints of Equation (54).

If one prescribes a design value of C_L in addition to values of K, T, x_o and s three different cases can be represented in the C_L-μ plane. These cases, which are illustrated schematically in Figure 16, arise from the fact that the limiting values of C_L for m=0 and m=1 will be different. Such differences for the special case of K=0 have been shown already in Figures 5 and 7. Similar behavior will also occur when K>0. As we have seen, the limiting value of C_L for m=0 does not depend on any prescribed pressure distribution. This is illustrated in Figure 12 for K=0. Similar trends for μ versus C_L occur when m=0 and K>0. For any cavitation number one can calculate the limiting value of C_L, regardless of the form chosen for p(x), once T, x_o and K have been prescribed. This limiting value of C_L, which corresponds to m=0 and $y_c(1)=0$, is denoted by C_{L_0} in Figure 16. In terms of the value of s

which characterizes the semi-elliptic pressure distribution, it is found in the C_L-μ plane that the slope of the ray for m=0 from the focal point on the C_L axis is very close to the ray for s=.2 when m=1. Since s defines the abcissa of the centroid of the semi-elliptic pressure distribution one may suspect that other nose-loaded pressure distributions, having their centroids located at about 20% of the chord, will be similarly related with respect to the slope of the ray for m=0 in the C_L-μ plane. When the ray for m=0 and the ray for m=1 coincide for a centroidal location s, a single value of μ is defined as long as the design C_L is less than or equal to C_{L_0}. This value of μ for such a value of C_L is denoted by μ_0 in Figure 16a. Physically this means that it is possible to prescribe pressure distributions p(x) and values of C_L, K, T and x_o for which only one value of μ is permissible regardless of the values of m and $y_c(1)$ which can then be paired to produce a series of profiles of varying performance and geometry. This is a rather special circumstance which will not often be encountered. It is far more likely that the m=1 ray for the prescribed pressure distribution will lie above the m=0 ray or below it as illustrated in Figure 16a. For the permissible range of μ which can be prescribed when the design C_L lies well to the left of C_{L_0} will then lie between μ_1 and μ_0 or μ_0 and μ_2, depending on whether the prescribed value of s lies below the m=0 ray as is the case for s_1, or above the ray for m=0, as is the case for s_2 in Figure 16a.

With the foregoing qualitative description of the circumstances surrounding the case illustrated by Figure 16a in mind we now turn to the calculation required to implement the determination of permissible values of the parameter μ. The first task is to calculate the limiting value, C_{L_0}. This calculation can be carried out by means of Equations (60) and

(61) with m=0 and $y_c(1)=0$. First, Equation (61) can be solved by iteration to determine the value of the cavity-length parameter, a, for the prescribed values of T and K. Then C_{L_0} can be found from Equation (60). Next when m=1, we can put $y_c(1)=0$ and repeat the iteration of Equation (61) in order to find the value of a and then the corresponding value of C_L can be found from Equation (60). The value of C_L determined by this second sequence of calculations corresponds to the intersection of the ray s_1 or s_2 with the solid curve labeled $y_c(1)=0$ in Figure 16a. These limiting C_L values are denoted by C_{L_1} and C_{L_2} in Figure 16a.

Now, in order to consider the case in which the design C_L is less than the values C_{L_0} and C_{L_1} which have just been established, we note from Equations (34) and (34a) that the relationship immediately following Eq. (34a),

$$f(a) = F_\eta + \frac{m}{\pi(1+K)} H_\eta = 0 \quad , \tag{62}$$

does not depend upon x_o or μ. Therefore if design values of C_L, K, T and p(x) are used in (62) along with m=0 and m=1 the value of the cavity length parameter can be found iteratively. Then the two pairs of quantities, (m,a), and the design quantities C_L, K, T, p(x) and the remaining parameter x_o, can be used in the equation

$$F_T = -\frac{m}{\pi(1+K)} H_T \tag{63}$$

in order to determine μ and μ_1 or μ_2. The functions H_T and F_T are defined by Equations (35) and (35a) respectively. The permissible range of μ which one can specify for subsequent design calculations will then be in the interval (μ_1, μ_0) or (μ_0, μ_2) as noted previously.

The foregoing discussion, while helpful for describing the basic nature of the calculation process for the estimating mode, indicates a rather cumbersome numerical procedure. It has been found more effective to program the estimating-mode calculations for C_{L0} and C_{L1} or C_{L2} to follow a different path from that discussed above. A more efficient determination of these limiting values of C_L can be based upon Equations (62) and (63) because they are also needed for other parts of the design process. In particular, since Equation (62) does not depend upon x_o or μ, if m is chosen in advance this equation contains the unknowns C_L and a. Then if we put $E=y_c(1)=0$ in Equation (40), thereby obtaining Equation (40a), we can solve it for C_L in terms of a, m, K and p(x). The iteration of a is then conducted by calculating an estimate for C_L for each estimate of a from Equation (62). This estimate for C_L along with the prescribed values of K, T, m and p(x) can be used in a regula-falsi routine to find that value of a which satisfies Equation (62). Clearly, this process will produce the limiting values C_{L0} and C_{L1} or C_{L2} illustrated in Figure 16a. Corresponding values of μ_0 and μ_1 or μ_2 then follow from Equation (63).

Of course, if the design pressure distribution is such that the ray for m=1 lies above the ray for m=0 as illustrated for s_2 in Figure 16a the procedure just outlined for the estimating mode holds without modification for values of the design C_L less than or equal to C_{L0}. However, suppose that the design value of C_L lies between C_{L1} and C_{L0} and that the value of s is such that the ray for m=1 is below that for m=0, as shown by the ray for s_1 in Figure 16a. Then the calculations for the estimating mode must be modified in accordance with the illustration of Figure 16b. In this case the value of μ_0 can be found from the procedure

described above when m=0 and the design values of C_L, K, T and x_o are prescribed as usual. However when m=1 the design value of C_L exceeds C_{L_1} so that this value of m is not available for profile design. Instead, we must find a value of m which is less than unity but which is just large enough to permit the design C_L to be the limiting value of C_L for $y_c(1)=0$. This value of m=m' will lie on a ray between m=m' and m=0 as shown in Figure 16b. The value of m' can be found from Equation (40a) by solving it for m. Thus we find

$$m' = \frac{2\pi\beta(1+K)/C_L - [(2a^2+3)\varepsilon+a\delta]/\ell(\delta-a\varepsilon)}{\frac{1}{\ell}\int_0^1 \sqrt{\frac{\ell-x}{x}}\, f(x)dx - [(2a^2+3)\varepsilon+a\delta]/\ell(\delta-a\varepsilon)} \; . \tag{40b}$$

Then since C_L in this equation is the design C_L, Equations (40b) and (62) can be used in a regula falsi routine to determine a and m'. Then m', a and the other design parameters can be used in Equation (63) to calculate μ'. Permissible μ values will lie between μ' and μ_0.

The third case for the estimation mode calculations arises when the design C_L lies between C_{L_0} and C_{L_2} and the pressure distribution leads to a ray, such as s_2 in Figure 16c, which lies above the m=0 ray. In this case, the value of μ_2 for m=1 can be found by iterating for a in Equation (62) and then solving for μ_2 from Equation (63). However, the value of m=0 is not accessible for profile design in this case. Instead we must find an intermediate value of m between 0 and 1. The lowest such value, m', which corresponds to the design value of C_L will be found when $y_c(1)=0$. Thus we can use Equations (40b) and (62) in a regula falsi routine to determine limiting values of a and m', as noted above. Then the

corresponding parameter μ' follows from Equation (63) and the permissible range of μ lies between μ' and μ_2.

It can be seen that, as the design C_L increases and the other parameters are held fixed, the value of s (or the centroid of the prescribed pressure distribution) must move nearer to the profile trailing edge. Indeed, if the design C_L is greater than C_{L_2} in Figures 16a and b, no solution can be found. Of course, it is evident from calculations of the sort which lead to Figure 5 that this rearward motion of the centroid of the prescribed pressure does not continue indefinitely because it is found that a centroidal distance between .6 and .7 will lead to infinite values for the limiting C_L when m=1. For values of m less than unity, this asymptotic value moves farther to the rear of the profile. However, for practically interesting values of C_L and the other design parameters this restriction is not too limiting.

In the design mode the calculations can go forward using the permissible μ values from the estimating mode. These calculations are carried out as described in the section on The Sequence of Calculations. In this case the iteration for a is executed using Equation (33a).

THE THIRD DESIGN PROCEDURE -- SUMMARY OF RESULTS

Preliminary Remarks

Nearly all of the calculated results to be discussed in this section are based on the semi-elliptical pressure distribution of Figure 8. Since the third design procedure contains the First and Second procedures as special cases, the numerical results presented here for the case of m=1, corresponding to shockless entry, will permit some regions on the wetted surface of the foil to be at the cavity pressure. This situation

violates the basic restriction that the pressure on the profile should be greater than the cavity pressure except at the trailing edge (and for shockless entry at the leading edge too.) Nonetheless, the basic boundary condition (vi) is satisfied. We could have avoided this contradiction if we had used the double-ellipse pressure distribution which was used for the first procedure in Reference 3. It was shown in that study that the hydrodynamic performance at shockless entry resulting from the semi-elliptical pressure distribution or the double-ellipse distribution exhibited only small differences. Therefore, we decided to overlook this contradiction for this one limiting case in the interest of simplicity and with the knowledge that valid design trends would still be obtained. All other cases, corresponding to $m<1$, involve the angle of attack or nose singularity so that the pressure on the profile will always exceed the cavity pressure except at the trailing edge.

For the sake of completeness, all hydrodynamic performance trends calculated in the course of this study are tabulated in the Appendix. The numerical methods used and the computer program developed for the calculations are described by Mr. Fernandez in a separate report [1].

Hydrodynamic Performance Trends

Perhaps the single most critical measure of hydrodynamic performance for fully cavitating profiles is the lift-to-drag ratio. Accordingly, our investigations have concentrated on the relationship between this factor and other design parameters. For example, Figure 17 shows the influence of peak pressure location on lift-to-drag ratio at zero cavitation number for a range of lift coefficients. For each lift coefficient, two curves are plotted corresponding to the largest and the smallest permissible value of μ when x_o=.1 and T=.1. This illustration shows that the selection

of μ can have an important effect on hydrofoil performance depending upon the location of peak pressure. It appears that for s-values in the neighborhood of .3 the effect of μ on L/D is minimal and that for tail-loaded profiles , it is best to use the smallest permissible μ-value, at least when K=0. For nose-loaded profiles the trend is reversed. However, it was found that maximum values of C_L/T as illustrated in Figure 10 were exceeded at all C_L values except C_L=.08. Thus no data are available at values of s equal to .2 and .1 for the higher lift coefficients.

Figure 18 provides the same information as Figure 17 except that now the cavitation number is .2. The most important factor revealed by this illustration is the significant decrease in L/D-values when K is increased from 0 to .2. We also see that at lower values of C_L the effect of μ on L/D increases for tail-loaded profiles as C_L is increased. For nose-loaded hydrofoil sections the effect of C_L changes is not large.

Both Figures 17 and 18 show the consistant trend of increasing L/D with increasing C_L. This same trend was found for the first and the second design procedures [4].

Figure 19 shows the effect of peak pressure location on L/D when the cavitation number varies and C_L is fixed at .16. Again, T=.1 and x_o=.1. This figure also shows that the effect of permissible μ variations is not too great for nose-loaded profiles, but for tail-loaded sections it can be significant, especially at very low K values.

Figure 20 shows the effect of increasing cavitation number on L/D. The value of s=.3 has been selected as a fixed parameter so that the variations due to the range of permissible μ values is small. From our preceding discussion we recognize that had we selected a tail-loaded

profile instead of the particular loading given by s=.3, the effect of μ variations would have been much more pronounced. However, the chief trend illustrated is the decrease of L/D with increasing K. The present trend agrees with that found for the first and second design procedures [4].

The influence on L/D of cavity thickness, T, for the range of design C_L values is shown in Figure 21. These curves are drawn for the fixed values of K=0, s=.3 and x_o=.1. As noted already the effect of variations in μ is not great because of the s-value selected. The general trend shown in this graph is the dramatic decrease in L/D with increasing cavity thickness. This trend has also been observed for the first and second design procedures [4].

The chief new aspect of the present investigation is the introduction of the two-point specification of cavity thickness. For a prescribed value of T, the parameter μ controls the specification of the cavity thickness near the nose. Further information on the effect of μ variations upon the values of L/D is given in Figure 22. In this figure the values of K=0, T=.1 and x_o=.1 are held fixed. Corresponding values of L/D and μ are plotted at the two design C_L's of .08 and .16 for the range of s values. Among other things, this illustration shows how L/D is independent of μ when s is somewhat greater than .3 but less than .4. We also see that in the neighborhood of s=.2 there will be only one permissible value of μ for the whole range of L/D within which m varies between 0 and 1. This figure also shows that in most cases L/D tends to decrease as μ increases. The exceptions to this situation occur when s lies between .2 and .3, roughly. We also see that at the higher C_L value of .16 most of this region is denied us by the cut-off corresponding to $y_c(1)=0$ and the permissible value of $C_{L_{max}}$.

Figure 23 is a cross plot of data from Figure 22 for constant values of μ. The purpose of this plot is to examine in some detail the L/D trends for various peak pressure locations for the two values of design C_L and for selected values of μ. The point at issue is whether or not one preserves the trends of increasing L/D as he prescribes peak pressure locations which move towards the nose when μ is held fixed. As Figure 23 shows, the answer to this question is yes in most cases, at least when K=0. On the other hand, for some C_L values this trend is reversed. This reversal occurs when the μ value selected lies to the left of the vertex at m=0, as shown for C_L=.08 in Figure 22. Indeed, as already noted, if μ is selected so as to coincide with the vertex, one finds only one permissible value of s for the entire range of L/D corresponding to $0 \leq m \leq 1$. In this case the trend line in Figure 23 would be vertical. Thus, the idea that nose loading is best from a purely hydrodynamic viewpoint is not always valid as already noted in Reference [4]. However, it appears to be true in most cases so that we might regard it as a useful rule of thumb. Another point illustrated again by Figure 23 is the fact that for constant μ values, the permissible range of s is limited by the constraints on m and $y_c(1)$.

Figure 24 is similar to Figure 22 except that now K=.2. The effect of this increase in cavitation number on the trends described above is remarkable. In many ways the situation is reversed. This is definitely true with respect to the effect m on L/D for nose-loaded profiles. For example, when s=.1, L/D increases as μ increases and at the same time m decreases from 1 to zero. We do see that near s=.2 there is only one value of μ for all values of L/D corresponding to m values between 0 and 1. In both plots of Figure 24 m is zero at the vertex where all

rays intersect. Then as a point moves from the vertex to the end of a ray, the value of m increases from 0 to 1. The plot for C_L=.08 and K=.2 is shown to a larger scale in Figure 25 so that the effects of μ upon L/D can be seen more clearly. Evidently, at this value of cavitation number and at this low value of C_L, better L/D's can be achieved if s is between .6 and .7 and m=1. On the other hand if C_L=.16, the best value of s is near .4 with m=1. However, even then, the L/D values obtained are low.

In the course of our numerical studies we carried out some computations to test the sensitivity of L/D to the accuracy of the lowest and highest permissible values of μ. It was found for x_o=.1 that if L/D and m were to be determined to four significant figures, these limiting values of μ needed to be known to five significant figures.

The preceding data have been presented in order to highlight some of the more important performance trends exhibited by third-design-procedure data. In order to present a somewhat more systematic overview of hydrodynamic performance, we present in Figures 26 through 35 plots of L/D versus C_D. These performance maps show contours of design C_L and s for cavity thickness values of T=.10, .15 and .20. Separate maps have been prepared for five values of the cavitation number, K=.00, .05, .10, .15, .20. For each value of K individual maps are given for the greatest and the least values of μ, consistant with the constraints $0 \leq m \leq 1$ and $y_c(1) \geq 0$. Since the value of the greatest μ and the least μ will vary widely from point to point on each map, the two maps for each K-value are simply designated by "MU MAX" or "MU MIN" on the plots. All maps have been contructed for x_o=.1. Complete tabulations of hydrodynamic data for these ten maps are given in the Appendix. Therefore one can look up other

pertinent data not presented on these plots should he need more detailed information. These maps seem to be rather self explanatory. Therefore we will only comment that they show again that nose-loaded profiles most often seem to have larger L/D values than tail-loaded sections. They also show ranges of design parameters for which the third design procedure can give a solution. Of course, not all cases investigated are presented in these performance maps. However, in order to present the hydrodynamic data behind all plots presented in this study these additional results are also given in supplementary tables in the Appendix.

In Reference 4, it was found useful to introduce the concept of "hydrodynamic equivalence". In this concept the design point (K, C_L, T) and the center of pressure location, $\bar{x}$, are the primary factors which govern hydrodynamic performance. It was found that if these parameters were the same for two profiles, their performance would be closely the same even though the shape of their pressure distributions is different. This concept was found to be useful even for comparing the performance of profiles designed by the first and second design procedures. Therefore we would expect this concept to be of value for comparisons of profiles designed in accordance with the third design procedure. In fact the center of pressure location is given in all tabulations in the Appendix so that one can test the concept of hydrodynamic equivalence again. We have not made this test in the present study. Instead we have preferred to explore the consequences of the third design procedure on the profile geometry. As we found in Reference 3, profile geometry is sensitive to the shape of the pressure distribution while hydrodynamic performance is less so.

Profile Geometric Trends

Typical profiles resulting from the third design procedure are illustrated starting with Figure 36. In all of these illustrations the upper graph shows to scale the profile wetted surface and the upper cavity contour in accordance with the nomenclature defined in Figure 1. In these figures the chord lines of all profiles are on the x-axis from x=0 to x=1.0. The y-axis shows contour ordinates to the same scale as the abscissa of each point. Note that only that portion of the cavity upper surface which lies directly above the wetted surface of the profile is plotted in these graphs. The trailing edge of the wetted surface is located at the point x=1.0 on all plots, and the lower surface of the cavity, which would extend beyond the trailing edge is not shown at all. The cavity thickness, T, for each design can be measured directly from the graphs as the vertical distance from the trailing edge of the profile (1.0, 0) to the upper surface of the cavity (1.0, T). The space between these two contours from the profile nose at (0,0) and on into the cavity beyond the trailing edge of the wetted surface if need be, is available for hydrofoil structure. We have not drawn in any foil structure in these plots, preferring to restrict our attention to the hydrodynamics of these flows. Of course we would assume that there would be some clearance between the upper surface of the cavity and the uppermost parts of the profile structure at the design condition. The lower plot in each figure shows the pressure distribution along the chord of the wetted surface with positive pressures plotted downward. These plots show the net perturbation pressure due to the prescribed pressure distribution plus the "flat plate" distribution due to the angle of attack above

the ideal value for shockless entry, as discussed in the text following Equation (43).

The examples selected for study have not been chosen because the profiles exhibited have good or poor performance or show favorable or unfavorable geometry. Instead our purpose has been to illustrate typical geometric trends which follow from changes in key hydrodynamic parameters. In this regard, we note that many of these general trends have already been discussed in Reference 4, where profiles designed by the first and second procedures are illustrated. Therefore the present discussion centers on the chief new ingredient contained in the third design procedure, namely; the influence of μ, the cavity thickness parameter at the nose, upon geometry and net pressure distribution.

For example, Figures 36 and 37 show two designs at zero cavitation number having the peak pressure of the prescribed semi-elliptic pressure distribution at s=.2. Figure 36 corresponds to the limiting case of m=1 so that it is a "first-design-procedure" hydrofoil section. We have noted previously that the value of s=.2 corresponds closely to a case as illustrated in Figures 22 and 23 for which μ is near the vertex corresponding to m=0 in a plot of L/D vs μ. Accordingly the value of μ changes very little over the permissible range of m. In this case, μ values shown in Figures 36 and 37 differ only in the fourth decimal place. The value of $y_c(1)$ for the profile of Figure 36 is .0081 so that the nose in this design is almost sharp. The value of $y_c(1)$ for the foil of Figure 37 is zero and the nose is sharp. The value of m is .6382 for this case so that the pressure distribution shows significant flat plate contribution. Because of this fact, the reduced amplitude of the prescribed semi-elliptical pressure distribution leads to less camber of the wetted

surface when compared to the case for m=1 shown in Figure 36. The corresponding difference in lift-to-drag ratio for the two cases is seen to be fairly small. Of course, neither of these designs is suitable for practical application. There is little or no clearance between the wetted surface and the upper-cavity contour near the profile noses. In addition, the design of Figure 36 shows an extensive region of zero pressure on its wetted surface. This situation is easily remedied by use of an additional quarter-elliptical distribution of low intensity distributed over the interval which now has zero pressure, as was done for the first procedure foils of Reference 1. The reason that this measure was not adopted in the present study is because our interest centers upon designs in which the flat plate contribution will cause the wetted surface pressure to exceed zero everywhere between the leading and trailing edges. The limiting case for m=1 is already treated adequately in Reference 1. The resulting comparisons of performance and geometric trends are influenced very little by this minor violation of one of our basic constraints. Of course one can not recommend such a prescribed pressure distribution for practical applications.

The next five illustrations, presented in Figures 38 through 42, illustrate the case in which s=.3 and K=0 and one expects to see a greater permissible range of μ values. We expect this because as can be seen from Figure 22, when s=.3, a considerable range of μ can take place with relatively small changes in L/D resulting. In fact if one can select an s-value which is on a horizontal line through the vertex at m=0, then L/D wll not vary over the permissible range of μ. In Figures 38 through 42, we have $19.906 \leq L/D \leq 20.135$ so that the condition of L/D invariance with respect to μ is nearly satisfied for the

permissible range, $.1464 \le \mu \le .1577$. The profile and pressure distribution shapes show descernible variations in this range. These variations can be understood quite readily if one examines the values of m and $y_c(1)$ for each of these profiles as given in Table I. For then, the general discussions

Table I

Fig.	38	39	40	41	42
m	.9998	.8537	.7075	.5609	.4148
$y_c(1)$	.0200	.0150	.0100	.0050	.0000

which relate to the importance of these factors on profile and cavity shapes as noted for hydrofoil sections designed at s=.2 are applicable to this case also.

Continuing our study of geometric trends at K=0 and T=.10 in Figures 43, 44 and 45, we show profiles designed for s=.7. For such tail-loaded sections the values of $y_c(1)$ needed to provide the required cavity thickness are higher than is the case for nose-loaded designs. Therefore, these profiles show higher drag and more nose rounding. As expected, the region of under camber moves to the rear and the moment coefficients of these profiles are greater in magnitude than is the case for nose-loaded designs. The values of m and $y_c(1)$ for these profiles are given in Table II below.

Table II

Fig.	43	44	45
m	.9998	.6079	.2158
$y_c(1)$	.0516	.0258	.0001

In Figures 46, 47, and 48 we return to nose-loading with s=.3. The values of μ selected for these graphs have been chosen to produce values of m as close as possible to .5 in order to retain pressure distributions which are the same for the three cases. The values of m were .4995, .4994 and .4994. Therefore the changes of profile shape are due to input parameters other than the pressure distribution. That is, we have made certain in these comparisons that $\bar{x}$, the center of pressure location, does not change. For example, Figure 46 shows the effect of changing cavity thicness for K=0. The case shown has an m-value between those of Figures 41 and 42 as indicated in Table I. An interpolation based upon the values in Table I indicates that $y_c(1)$=.0029 for m=.4995. These values pertain to T=.1. In Figure 46, T=.2 and $y_c(1)$=.0529, which is about 18 times larger than the value of $y_c(1)$ when T=.1. Thus the change of cavity thickness from .1 to .2 can be ascribed entirely to the increase in the value of $y_c(1)$. As a result of this increase in $y_c(1)$ there is rounding of the profile nose. In Figures 47 and 48, we return the cavity thickness, T, to its previous value of .1. However, the value of K is increased to .1 and then to .2. Again, because m is held constant, the cavity thickness requirement of T=.1 for these K values results in increased values of $y_c(1)$ as shown in Table III.

Table III

Fig.	-	47	48
K=	0	.1	.2
$y_c(1)$	.0029	.0190	.0322

Again the increased rounding of the profile nose which accompanies this increase in $y_c(1)$ is observed.

As our final study of profile geometry to be expected from designs developed from the third design procedure, we consider some sections based upon a modified "three-term" pressure distribution [4,6]. This distribution is shown in Figure 49 for a design lift coefficient of .12. As illustrated in the figure, two uses are made of this distribution. First we reverse the distribution so as to produce a nose-loaded profile. Then we use the distribution in the customary way to provide a tail-loaded section.

Four profiles, resulting from the third design procedure when T=.1 and K=0, are shown in Figures 50, 51, 52 and 53 for reversed-three term and three-term pressure distributions. We believe that the study of hydrodynamic equivalence reported in Reference 4 supports the view that the value of peak pressure location, s, recorded on these plots is no longer a significant parametric quantity for comparison of performance with results from semi-elliptic pressure distributions, for example. Instead the important parameter as far as hydrodynamic performance is concerned is the center of pressure location, $\bar{x}$. These values are tabulated in the Appendix. On the other hand, since profile geometry is sensitive to details of the prescribed pressure distribution and the point-drag amplitude these distributions tend to be in a class by themselves with respect to the geometry resulting from the application of the third design procedure. We might consider these profiles as being more representative of the kind of pressure distribution one might wish to specify for actual use.

Figures 50 and 51 show the profiles derived from the third design procedure for the reversed three-term prescribed pressure distribution. In Figure 50, m=1.0 and $y_c(1)=.0228$. Figure 51 shows the profile and net pressure distribution obtained when m=.3840 and $y_c(1)=0$. Therefore the value of μ shown on Figures 50 and 51 are $\mu|_{max}$ and $\mu|_{min}$ respectively. Note that the L/D value for the profile of Figure 51 exceeds slightly that shown in Figure 50. This increase is caused by the fact that the location of $\bar{x}$ moves forward because of the flat plate solution, shown to be part of the pressure distribution of Figure 51.

Figures 52 and 53 show the geometric trends obtained for the three-term prescribed pressure, corresponding to tail-loading. Again, Figure 52 corresponds to the limiting case for m=1 and Figure 53 to the limit for $y_c(1)=0$. In this latter case, the value of m is .2274 so that $\bar{x}$ is moved towards the nose compared to the profile of Figure 52. Accordingly, the value of L/D is increased for this case as compared to that shown in Figure 52. Again the values of μ shown for these two profiles are limiting permissible values, $\mu|_{max}=.2085$ and $\mu|_{min}=.1543$. It is worth noting that the value of L/D for the profile of Figure 53 is nearly as good as that for the shockless entry case of Figure 50. These two cases show again the important influence on performance of the center of pressure location as distinct from peak pressure location. On the other hand, the effect of distributing the prescribed pressure gradually over the chord instead prescribing the more concentrated peaks as obtained in many of the semi-elliptical examples given previously, is shown by the more gradual camber of the wetted surfaces in these last four examples. Perhaps, one conclusion which can be drawn from these comparisons is that the designer can, by a judicious selection of

prescribed pressure distribution and the value of μ, obtain profiles of better than average performance and still provide sufficient clearance between the upper surface of the cavity and the wetted surface to allow realistic structural criteria to be satisfied. The perusal of this objective is beyond the scope of the present study.

Off-Design Performance

Once a profile has been designed, it is important to examine its performance at possible operating conditions which differ from those considered in its design. Considerations of this sort depend upon the solution of the direct problem and the literature is replete with various approaches to its solution. One approach which appears to work well with the present inverse technique is that described in Reference 4. This particular linearized approach has been designed to permit one to determine the operating range of a particular design in terms of cavitation number and minimum attack angle for cavity profile interference.

In order to illustrate the off-design performance, one might expect to achieve with the third design procedure we have selected one profile from those presented in the preceding section. The profile of Figure 40 has been analyzed for off-design performance and the results are presented in Figure 54. In this figure, the lift-to-drag ratio is plotted against the cavitation number for selected values of attack angle, α, and cavity length, ℓ. Regions of cavity-foil interference have also been delineated on this figure. In arriving at the boundary between interference and noninterference, we used a rather simple shape for the upper surface of the hydrofoil section. It was assumed that, t, the ordinates of the upper surface of the hydrofoil is θ times the ordinates of the upper surface of the cavity at the design point. That

is, $t=\theta y(x)$. In the example of Figure 54, θ is 80% and the hydrofoil has a kind of wedge shape. The boundary marked in Figure 54 defines the locus of points at which the upper surface of the cavity at off-design is just tangent to the upper surface of the foil at some chordwise point.

CONCLUSIONS

The work completed to date has provided a rather flexible preliminary design tool which one can use to explore the important hydrodynamic parameters surrounding the design of a supercavitating hydrofoil section. The work has been carried out with the needs of the designer who wants to explore mixed-foil concepts in mind. Naturally, we have limited our considerations to the hydrodynamic aspects of the design process. We hope that the methods proposed will enable the important compromises between hydrodynamic and structural criteria to be addressed more efficiently than might otherwise be possible.

It has been found that the results of the present study reinforce conclusions of our work on the first and second design procedures with respect to the effect of center of pressure location and other parameters on hydrodynamic performance and the influence of the prescribed pressure distribution shape on wetted surface geometry.

The chief new result from the third method of profile design results from the two-point cavity thickness control which is possible with this more general theory. In calculations based upon this theory, one specifies the cavity thickness at a point x_o near the nose to be μT, where $\mu<1$. Because of the fact that the pressure on the wetted surface must exceed the cavity pressure, it is found that μ can not be prescribed

with complete arbitrariness. The permissible range of μ is found to depend on T, x_o, C_L, K and, to some extent, upon the shape of the prescribed pressure distribution. In spite of these restrictions on the range of μ, the addition of this parameter to those already available from the first and second design procedures significantly enhances the flexibility of the third design procedure.

Of course this procedure, being based upon linearized theory, like Wang and Shen's mixed foil theory, is chiefly useful for preliminary design. Once a few candidate hydrofoil sections have been designed, we must make a final selection using more exact analysis methods. Another point has been noted already which is peculiar to the way we have formulated the problem. It will be noted that because the chord line passes through the trailing edge of the profile in this theory, the cavity thickness T is a clearance between the wetted surface of the profile and the upper surface of the cavity. In the case of the cavity thickness near the nose, the distance μT is measured from the chord line and not the wetted surface. Therefore μT is only indirectly related to the clearance between the wetted surface and the upper surface of the cavity. As a result our study shows that occasionally one can obtain profiles which have cavity contours which cut the wetted surface. Therefore one can not guarantee from the outset that his design will be entirely satisfactory. As we have noted already, if one were to change the condition $y(x_o)=\mu T$ to read $y(x_o)-\eta(x_o)=\omega T$ and implement the design process accordingly, the occasional interference between cavity and wetted surface could be eliminated. However in this case too, the parameter, ω, would be limited in its range to certain permissible values which must be searched out before a design can be completed. In the

present somewhat simpler theory the limited range of μ makes it possible for one to explore the possibilities afforded by various selections of μ when other design parameters are held fixed. Thus he can determine from the resulting profile and cavity contours which of the several designs if any, is the most satisfactory, not only from the viewpoint of profile geometry but of hydrodynamic performance also. Thus we feel that the procedure proposed in this study offers a flexible design tool for the preliminary design of fully cavitating hydrofoil sections employing any one of the three design procedures studied. The new computer program for the design method has been written to operate in accordance with either the first, second or the third procedure. However the added flexibility of the third procedure which enables the designer to examine a variety of geometric and hydrodynamic aspects relating to his practical design goals by varying μ within the permissible range for systematic families of pressure distribution shape should make the third procedure the most useful of the three methods.

REFERENCES

[1] Fernandez, J., "Design Implementation for Supercavitating Hydrofoils with Two-Point Cavity Thickness Control," ARL Internal Memorandum, File No. 77-199, June 1977.

[2] Wang, D. P. and Shen, Y. T., "A Theory for High-Speed Hydrofoils," NSRDC Evaluation Report SPD-478-14, June 1975.

[3] Wang, D. P. and Shen, Y. T., "A Validation Study of the Mixed-Foil Concept for High-Speed Hydrofoils," Journal of Ship Research, Vol. 20, No. 2, June 1976, pp. 85-94.

[4] Parkin, B. R., Davis, R. F. and Fernandez, J., "A Numerical Design Study of Fully Cavitating Hydrofoil Sections Having Prescribed Pressure Distributions," ARL Technical Memorandum, File No. 75-170, June 30, 1975.

________________, "Hydrodynamic Trends for Preliminary Design of Fully Cavitating Hydrofoil Sections," Marine Technology, Vol. 14, No. 1, January 1977.

[5] Parkin, B. R., "The Inverse Problem of the Linearized Theory of Fully-Cavitating Hydrofoils," the RAND Corporation Memorandum, RM-3566-PR, 1700 Main Street, Santa Monica, California, September 1964 (AD 606038).

[6] Parkin, B. R. and Grote, R. S., "Inverse Methods in the Linearized Theory of Fully-Cavitating Hydrofoils," Trans. ASME, Journal of Basic Engineering, Vol. 86, Series D, No. 4, December 1964.

[7] Milne-Thomson, L. M., Theoretical Aerodynamics, Fourth Edition, Dover Publications, New York, 1973, pp. 147-156.

APPENDIX

TABLES OF HYDRODYNAMIC PERFORMANCE

NOTATION

K	- cavitation number
T	- cavity thickness at trailing edge
XO	- location of second cavity thickness control point on chord line, x_o
CL	- lift coefficient, C_L
S	- peak pressure location, s
MU	- nose cavity thickness parameter, μ
L/D	- lift to drag ratio
CM	- moment coefficient, C_M
CD	- drag coefficient, C_D
XBAR	- center of pressure location along chord line, $\bar{x}$
ALPHA	- angle of attack α
L	- cavity length parameter, $\ell=1+a^2$
YC(1)	- point-drag solution strength, $y_c(1)=E/a$
M	- fraction of lift born by prescribed pressure distribution, m
ACAP	- strength of leading edge or "flat plate" solution, A
BINT	- cavity closure singularity strength, B
DINT	- value of $\alpha-C_o$ where C_o is the first Fourier coefficient for the camber function

THIRD FOIL DESIGN METHOD WITH X0= 0.100

K= 0.000 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.13966	17.45013	-0.00799	0.00458	0.09991	3.73419	0.00603	0.99995	-0.00000
0.10	0.16161	15.07072	-0.02500	0.00531	0.31249	3.33078	0.00720	0.00005	-0.05093
0.20	0.16161	15.07061	-0.02500	0.00531	0.31250	3.33076	0.00720	0.00000	-0.05093
0.20	0.16175	16.26080	-0.01598	0.00492	0.19980	3.43643	0.02203	1.00000	0.00000
0.30	0.16162	15.07065	-0.02500	0.00531	0.31250	3.33075	0.00720	0.00007	-0.05093
0.30	0.17448	15.28097	-0.02398	0.00524	0.29969	3.23419	0.03002	0.99992	-0.00000
0.40	0.16162	15.07060	-0.02500	0.00531	0.31250	3.33074	0.00720	0.00004	-0.05093
0.40	0.18419	14.33468	-0.03197	0.00553	0.39959	3.05901	0.03561	0.99995	-0.00000
0.50	0.16162	15.07056	-0.02500	0.00531	0.31251	3.33074	0.00720	0.00003	-0.05093
0.50	0.19365	13.19810	-0.03996	0.00606	0.49948	2.86480	0.04066	0.99997	-0.00000
0.60	0.16162	15.07054	-0.02500	0.00531	0.31251	3.33074	0.00720	0.00002	-0.05093
0.60	0.20450	12.35126	-0.04795	0.00648	0.59939	2.67051	0.04697	0.99998	-0.00000
0.70	0.16162	15.07053	-0.02500	0.00531	0.31251	3.33074	0.00720	0.00002	-0.05093
0.70	0.21265	11.49883	-0.05594	0.00696	0.69930	2.49532	0.05107	0.99998	-0.00000
0.80	0.16162	15.07052	-0.02500	0.00531	0.31251	3.33074	0.00720	0.00002	-0.05093
0.80	0.22125	10.52690	-0.06394	0.00760	0.79919	2.29336	0.05525	0.99998	-0.00000
0.90	0.16162	15.07052	-0.02500	0.00531	0.31251	3.33074	0.00720	0.00001	-0.05093
0.90	0.23299	9.21634	-0.07193	0.00868	0.89909	1.99713	0.06095	0.99998	-0.00000

CL= 0.10

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.20	0.15002	17.88930	-0.02912	0.00559	0.29124	3.47216	0.00000	0.18863	-0.05165
0.20	0.15016	19.26467	-0.01998	0.00519	0.19980	3.57935	0.01504	1.00000	0.00000
0.30	0.15196	17.62263	-0.03109	0.00567	0.31093	3.43244	0.00000	0.12262	-0.05586
0.30	0.16607	17.88370	-0.02997	0.00559	0.29969	3.32654	0.02503	0.99993	-0.00000
0.40	0.15277	17.48100	-0.03211	0.00572	0.32108	3.41379	0.00000	0.09849	-0.05739
0.40	0.17821	16.55725	-0.03996	0.00604	0.39959	3.10756	0.03201	0.99996	-0.00000
0.50	0.15334	17.34541	-0.03281	0.00577	0.32814	3.39854	0.00000	0.08363	-0.05834
0.50	0.19004	14.99876	-0.04995	0.00667	0.49948	2.86479	0.03832	0.99997	-0.00000
0.60	0.15376	17.27805	-0.03327	0.00579	0.33268	3.38918	0.00000	0.07035	-0.05918
0.60	0.20360	13.86237	-0.05994	0.00721	0.59940	2.62194	0.04621	0.99998	-0.00000
0.70	0.15406	17.20068	-0.03372	0.00581	0.33717	3.38065	0.00000	0.06377	-0.05960
0.70	0.21379	12.74002	-0.06993	0.00785	0.69930	2.40295	0.05134	0.99998	-0.00000
0.80	0.15433	17.11044	-0.03408	0.00584	0.34084	3.37175	0.00000	0.05822	-0.05996
0.80	0.22454	11.48705	-0.07992	0.00871	0.79919	2.15050	0.05657	0.99998	-0.00000
0.90	0.15463	16.98604	-0.03430	0.00589	0.34303	3.36048	0.00000	0.05205	-0.06035
0.90	0.23921	9.84318	-0.08991	0.01016	0.89909	1.78021	0.06369	0.99999	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
CL= 0.12									
0.20	0.13849	21.13365	-0.02887	0.00568	0.24057	3.66491	0.00000	0.63825	-0.02764
0.20	0.13857	21.98557	-0.02398	0.00546	0.19980	3.72226	0.00805	1.00000	0.00000
0.30	0.14637	19.90634	-0.03686	0.00603	0.30719	3.50366	0.00000	0.41474	-0.04471
0.30	0.15766	20.13481	-0.03596	0.00596	0.29969	3.41889	0.02003	0.99995	-0.00000
0.40	0.14955	19.28735	-0.04098	0.00622	0.34152	3.42793	0.00000	0.33316	-0.05094
0.40	0.17223	18.41469	-0.04795	0.00652	0.39959	3.15611	0.02842	0.99997	-0.00000
0.50	0.15196	18.71475	-0.04385	0.00641	0.36540	3.36600	0.00000	0.28290	-0.05478
0.50	0.18642	16.43433	-0.05994	0.00730	0.49948	2.86479	0.03599	0.99998	-0.00000
0.60	0.15368	18.43719	-0.04569	0.00651	0.38078	3.32802	0.00000	0.23800	-0.05821
0.60	0.20270	15.01850	-0.07193	0.00799	0.59940	2.57336	0.04545	0.99998	-0.00000
0.70	0.15488	18.12416	-0.04751	0.00662	0.39595	3.29338	0.00000	0.21574	-0.05991
0.70	0.21492	13.64390	-0.08392	0.00880	0.69930	2.31059	0.05161	0.99999	-0.00000
0.80	0.15599	17.76637	-0.04900	0.00675	0.40836	3.25724	0.00000	0.19696	-0.06135
0.80	0.22782	12.13784	-0.09590	0.00989	0.79919	2.00764	0.05788	0.99999	-0.00000
0.90	0.15722	17.28581	-0.04990	0.00694	0.41579	3.21148	0.00000	0.17609	-0.06294
0.90	0.24543	10.20870	-0.10789	0.01175	0.89909	1.56328	0.06642	0.99999	-0.00000
CL= 0.14									
0.20	0.12697	24.27583	-0.02861	0.00577	0.20437	3.85766	0.00000	0.95940	-0.00362
0.20	0.12698	24.39972	-0.02797	0.00574	0.19980	3.86517	0.00105	1.00000	0.00000
0.30	0.14078	21.90018	-0.04263	0.00639	0.30452	3.57488	0.00000	0.62340	-0.03357
0.30	0.14925	22.08302	-0.04196	0.00634	0.29969	3.51124	0.01504	0.99996	-0.00000
0.40	0.14653	20.75934	-0.04986	0.00674	0.35611	3.44207	0.00000	0.50078	-0.04449
0.40	0.16625	19.96704	-0.05594	0.00701	0.39959	3.20467	0.02482	0.99997	-0.00000
0.50	0.15058	19.73692	-0.05488	0.00709	0.39201	3.33347	0.00000	0.42523	-0.05123
0.50	0.18281	17.57643	-0.06993	0.00797	0.49948	2.86479	0.03365	0.99998	-0.00000
0.60	0.15359	19.25252	-0.05812	0.00727	0.41514	3.26687	0.00000	0.35774	-0.05724
0.60	0.20180	15.89789	-0.08392	0.00881	0.59940	2.52479	0.04470	0.99999	-0.00000
0.70	0.15571	18.71472	-0.06131	0.00748	0.43794	3.20611	0.00000	0.32429	-0.06022
0.70	0.21606	14.29335	-0.09790	0.00979	0.69930	2.21821	0.05187	0.99999	-0.00000
0.80	0.15764	18.11102	-0.06392	0.00773	0.45659	3.14273	0.00000	0.29606	-0.06274
0.80	0.23111	12.56450	-0.11169	0.01114	0.79919	1.86478	0.05919	0.99999	-0.00000
0.90	0.15980	17.31834	-0.06549	0.00808	0.46777	3.06248	0.00000	0.26469	-0.06554
0.90	0.25164	10.39628	-0.12587	0.01347	0.89910	1.34637	0.06916	0.99999	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.30	0.13518	23.64160	-0.04840	0.00677	0.30251	3.64609	0.00000	0.77989	-0.02242
0.30	0.14085	23.76942	-0.04795	0.00673	0.29969	3.60358	0.01005	0.99996	-0.00000
0.40	0.14341	21.95618	-0.05873	0.00729	0.36706	3.45622	0.00000	0.62649	-0.03805
0.40	0.16027	21.26335	-0.06393	0.00752	0.39959	3.25322	0.02122	0.99998	-0.00000
0.50	0.14920	20.48938	-0.06[illegible]2	0.00781	0.41197	3.30094	0.00000	0.53198	-0.04767
0.50	0.17919	18.48112	-0.07992	0.00866	0.49948	2.86478	0.03132	0.99998	-0.00000
0.60	0.15351	19.80867	-0.07054	0.00808	0.44090	3.20572	0.00000	0.44755	-0.05627
0.60	0.20089	16.55986	-0.09590	0.00966	0.59940	2.47621	0.04394	0.99999	-0.00000
0.70	0.15653	19.06366	-0.07511	0.00839	0.46943	3.11884	0.00000	0.40570	-0.06053
0.70	0.21719	14.74898	-0.11189	0.01085	0.69930	2.12584	0.05214	0.99999	-0.00000
0.80	0.15929	18.24055	-0.07884	0.00877	0.49277	3.02823	0.00000	0.37039	-0.06413
0.80	0.23439	12.82701	-0.12787	0.01247	0.79919	1.72192	0.06051	0.99999	-0.00000
0.90	0.16238	17.18102	-0.08108	0.00931	0.50674	2.91348	0.00000	0.33114	-0.06813
0.90	0.25786	10.46140	-0.14386	0.01529	0.89910	1.12945	0.07190	0.99999	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

W= 0.000 T= 0.150

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.16248	8.15554	-0.00799	0.00981	0.09991	5.16657	0.03103	0.99993	-0.00000
0.10	0.17711	7.36938	-0.02500	0.01086	0.31248	4.76318	0.03220	0.00007	-0.05093
0.20	0.17711	7.36933	-0.02500	0.01086	0.31250	4.76315	0.03220	0.00000	-0.05093
0.20	0.17720	7.76925	-0.01598	0.01030	0.19980	4.86883	0.04703	1.00000	0.00000
0.30	0.17712	7.36933	-0.02500	0.01086	0.31250	4.76314	0.03221	0.00011	-0.05092
0.30	0.18569	7.44103	-0.02398	0.01075	0.29970	4.66659	0.05502	0.99988	-0.00001
0.40	0.17712	7.36931	-0.02500	0.01086	0.31251	4.76313	0.03220	0.00006	-0.05093
0.40	0.19217	7.11486	-0.03197	0.01124	0.39959	4.49141	0.06061	0.99993	-0.00000
0.50	0.17712	7.36929	-0.02500	0.01086	0.31251	4.76313	0.03220	0.00004	-0.05093
0.50	0.19847	6.71024	-0.03996	0.01192	0.49948	4.29719	0.06566	0.99995	-0.00000
0.60	0.17712	7.36929	-0.02500	0.01086	0.31251	4.76313	0.03220	0.00003	-0.05093
0.60	0.20571	6.39890	-0.04795	0.01250	0.59939	4.10291	0.07197	0.99996	-0.00000
0.70	0.17712	7.36929	-0.02500	0.01086	0.31251	4.76313	0.03220	0.00003	-0.05093
0.70	0.21114	6.07631	-0.05594	0.01317	0.69929	3.92772	0.07607	0.99997	-0.00000
0.80	0.17712	7.36928	-0.02500	0.01086	0.31251	4.76312	0.03220	0.00002	-0.05093
0.80	0.21687	5.69631	-0.06393	0.01404	0.79918	3.72576	0.08025	0.99997	-0.00000
0.90	0.17712	7.36927	-0.02500	0.01086	0.31251	4.76312	0.03220	0.00002	-0.05093
0.90	0.22470	5.16117	-0.07193	0.01550	0.89909	3.42953	0.08595	0.99998	-0.00000

CL= 0.10

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.15107	9.93977	-0.00999	0.01006	0.09991	5.38394	0.02004	0.99995	-0.00000
0.10	0.16936	8.77715	-0.03125	0.01139	0.31249	4.87967	0.02150	0.00006	-0.06366
0.20	0.16936	8.77708	-0.03125	0.01139	0.31250	4.87964	0.02150	0.00000	-0.06366
0.20	0.16948	9.36349	-0.01998	0.01068	0.19980	5.01174	0.04004	1.00000	0.00000
0.30	0.16937	8.77709	-0.03125	0.01139	0.31250	4.87962	0.02151	0.00009	-0.06366
0.30	0.18009	8.39145	-0.02997	0.01126	0.29969	4.75894	0.05003	0.99990	-0.00001
0.40	0.16937	8.77707	-0.03125	0.01139	0.31250	4.87962	0.02151	0.00005	-0.06366
0.40	0.18818	8.40940	-0.03996	0.01189	0.39959	4.53996	0.05701	0.99994	-0.00000
0.50	0.16937	8.77705	-0.03125	0.01139	0.31251	4.87961	0.02151	0.00004	-0.06366
0.50	0.19606	7.53345	-0.04995	0.01277	0.49948	4.29719	0.06332	0.99996	-0.00000
0.60	0.16937	8.77705	-0.03125	0.01139	0.31251	4.87961	0.02151	0.00003	-0.06366
0.60	0.20511	7.39757	-0.05994	0.01352	0.59939	4.05433	0.07121	0.99997	-0.00000
0.70	0.16937	8.77704	-0.03125	0.01139	0.31251	4.87961	0.02151	0.00002	-0.06366
0.70	0.21190	6.95269	-0.06993	0.01438	0.69930	3.83535	0.07634	0.99997	-0.00000
0.80	0.16937	8.77704	-0.03125	0.01139	0.31251	4.87961	0.02150	0.00002	-0.06366
0.80	0.21906	6.43747	-0.07992	0.01553	0.79919	3.58290	0.08157	0.99998	-0.00000
0.90	0.16937	8.77702	-0.03125	0.01139	0.31251	4.87961	0.02150	0.00002	-0.06366
0.90	0.22884	5.72827	-0.08991	0.01746	0.89909	3.21261	0.08869	0.99998	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.12

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.13966	11.63342	-0.01199	0.01032	0.09991	5.60129	0.00905	0.99995	-0.00000
0.10	0.16161	10.04714	-0.03750	0.01194	0.31249	4.99616	0.01080	0.00005	-0.07639
0.20	0.16161	10.04707	-0.03750	0.01194	0.31250	4.99613	0.01080	0.00000	-0.07639
0.20	0.16175	10.34055	-0.02398	0.01107	0.19980	5.15465	0.03305	1.00000	0.00000
0.30	0.16162	10.04709	-0.03750	0.01194	0.31250	4.99611	0.01081	0.00008	-0.07639
0.30	0.17448	10.18730	-0.03596	0.01178	0.29969	4.85128	0.04503	0.99992	-0.00001
0.40	0.16162	10.04706	-0.03750	0.01194	0.31250	4.99611	0.01081	0.00004	-0.07639
0.40	0.18419	9.55644	-0.04795	0.01256	0.39959	4.58852	0.05342	0.99996	-0.00000
0.50	0.16162	10.04703	-0.03750	0.01194	0.31251	4.99610	0.01081	0.00003	-0.07639
0.50	0.19365	8.79872	-0.05994	0.01364	0.49948	4.29719	0.06099	0.99997	-0.00000
0.60	0.16162	10.04702	-0.03750	0.01194	0.31251	4.99610	0.01081	0.00002	-0.07639
0.60	0.20450	8.23418	-0.07193	0.01457	0.59939	4.00576	0.07045	0.99998	-0.00000
0.70	0.16162	10.04702	-0.03750	0.01194	0.31251	4.99610	0.01081	0.00002	-0.07639
0.70	0.21265	7.66589	-0.08392	0.01565	0.69930	3.74298	0.07661	0.99998	-0.00000
0.80	0.16162	10.04701	-0.03750	0.01194	0.31251	4.99610	0.01081	0.00002	-0.07639
0.80	0.22125	7.01795	-0.09590	0.01710	0.79919	3.44004	0.08288	0.99998	-0.00000
0.90	0.16162	10.04699	-0.03750	0.01194	0.31251	4.99610	0.01081	0.00001	-0.07639
0.90	0.23299	6.14423	-0.10789	0.01953	0.89909	2.99569	0.09142	0.99999	-0.00000

CL= 0.14

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.15255	11.28685	-0.04222	0.01240	0.30157	5.14892	0.00000	0.05141	-0.08454
0.10	0.15386	11.19360	-0.04375	0.01251	0.31249	5.11265	0.00011	0.00004	-0.08912
0.20	0.15386	11.19351	-0.04375	0.01251	0.31250	5.11262	0.00011	0.00000	-0.08913
0.20	0.15402	12.20968	-0.02797	0.01147	0.19980	5.29756	0.02605	1.00000	0.00000
0.30	0.15387	11.19353	-0.04375	0.01251	0.31250	5.11261	0.00011	0.00006	-0.08912
0.30	0.16887	11.37191	-0.04196	0.01231	0.29969	4.94363	0.04004	0.99993	-0.00001
0.40	0.15387	11.19350	-0.04375	0.01251	0.31250	5.11260	0.00011	0.00003	-0.08912
0.40	0.18021	10.57355	-0.05594	0.01324	0.39959	4.63707	0.04982	0.99996	-0.00000
0.50	0.15387	11.19348	-0.04375	0.01251	0.31250	5.11260	0.00011	0.00002	-0.08912
0.50	0.19124	9.62880	-0.06993	0.01454	0.49948	4.29719	0.05865	0.99997	-0.00000
0.60	0.15387	11.19347	-0.04375	0.01251	0.31251	5.11260	0.00011	0.00002	-0.08913
0.60	0.20390	8.93510	-0.08392	0.01567	0.59940	3.95718	0.06970	0.99998	-0.00000
0.70	0.15387	11.19346	-0.04375	0.01251	0.31251	5.11260	0.00011	0.00002	-0.08913
0.70	0.21341	8.24577	-0.09790	0.01698	0.69930	3.65061	0.07687	0.99998	-0.00000
0.80	0.15387	11.19344	-0.04375	0.01251	0.31251	5.11260	0.00011	0.00001	-0.08913
0.80	0.22344	7.47101	-0.11189	0.01874	0.79919	3.29718	0.08419	0.99998	-0.00000
0.90	0.15387	11.19344	-0.04375	0.01251	0.31251	5.11259	0.00011	0.00001	-0.08913
0.90	0.23713	6.44564	-0.12587	0.02172	0.89909	2.77878	0.09416	0.99999	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.20	0.14618	12.65488	-0.04356	0.01264	0.27224	5.30461	0.00000	0.35724	-0.06547
0.20	0.14629	13.47931	-0.03197	0.01187	0.19980	5.44047	0.01906	1.00000	0.00000
0.30	0.15010	12.27909	-0.04952	0.01303	0.30953	5.18427	0.00000	0.23216	-0.07821
0.30	0.16327	12.44705	-0.04795	0.01285	0.29969	5.03598	0.03505	0.99994	-0.00001
0.40	0.15173	12.08299	-0.05260	0.01324	0.32874	5.12775	0.00000	0.18649	-0.08286
0.40	0.17622	11.47583	-0.06393	0.01394	0.39959	4.68562	0.04622	0.99996	-0.00000
0.50	0.15288	11.89745	-0.05474	0.01345	0.34211	5.08153	0.00000	0.15635	-0.08573
0.50	0.18863	10.34261	-0.07992	0.01547	0.49948	4.29719	0.05631	0.99998	-0.00000
0.60	0.15373	11.80605	-0.05612	0.01355	0.35072	5.05319	0.00000	0.13322	-0.08829
0.60	0.20330	9.52190	-0.09590	0.01680	0.59940	3.90861	0.06894	0.99998	-0.00000
0.70	0.15433	11.70172	-0.05747	0.01367	0.35921	5.02733	0.00000	0.12076	-0.08956
0.70	0.21417	8.71609	-0.11189	0.01836	0.69930	3.55825	0.07714	0.99998	-0.00000
0.80	0.15488	11.58087	-0.05859	0.01382	0.36616	5.00037	0.00000	0.11025	-0.09063
0.80	0.22563	7.82233	-0.12787	0.02045	0.79919	3.15432	0.08551	0.99999	-0.00000
0.90	0.15549	11.41584	-0.05925	0.01402	0.37032	4.96621	0.00000	0.09856	-0.09182
0.90	0.24128	6.65947	-0.14385	0.02403	0.89909	2.56186	0.09690	0.99999	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
CL= 0.08									
0.10	0.17389	4.70655	-0.00799	0.01700	0.09992	6.59897	0.05603	0.99991	-0.00000
0.10	0.18486	4.35572	-0.02500	0.01837	0.31248	6.19558	0.05720	0.00010	-0.05092
0.20	0.18486	4.35569	-0.02500	0.01837	0.31250	6.19555	0.05720	0.00000	-0.05093
0.20	0.18493	4.53574	-0.01598	0.01764	0.19980	6.30122	0.07203	1.00000	0.00000
0.30	0.18487	4.35569	-0.02500	0.01837	0.31250	6.19552	0.05721	0.00014	-0.05092
0.30	0.19130	4.38821	-0.02398	0.01823	0.29970	6.09899	0.08002	0.99983	-0.00001
0.40	0.18487	4.35568	-0.02500	0.01837	0.31251	6.19552	0.05721	0.00008	-0.05093
0.40	0.19615	4.23937	-0.03197	0.01887	0.39958	5.92381	0.08561	0.99990	-0.00001
0.50	0.18487	4.35567	-0.02500	0.01837	0.31251	6.19552	0.05720	0.00006	-0.05093
0.50	0.20088	4.05142	-0.03996	0.01975	0.49948	5.72959	0.09066	0.99993	-0.00000
0.60	0.18487	4.35567	-0.02500	0.01837	0.31251	6.19551	0.05720	0.00004	-0.05093
0.60	0.20631	3.90421	-0.04795	0.02049	0.59939	5.53531	0.09697	0.99995	-0.00000
0.70	0.18487	4.35567	-0.02500	0.01837	0.31251	6.19551	0.05720	0.00004	-0.05093
0.70	0.21038	3.74917	-0.05594	0.02134	0.69929	5.36013	0.10107	0.99996	-0.00000
0.80	0.18487	4.35566	-0.02500	0.01837	0.31251	6.19551	0.05720	0.00003	-0.05093
0.80	0.21468	3.56311	-0.06393	0.02245	0.79918	5.15816	0.10525	0.99996	-0.00000
0.90	0.18487	4.35566	-0.02500	0.01837	0.31252	6.19550	0.05720	0.00003	-0.05093
0.90	0.22055	3.29435	-0.07193	0.02428	0.89908	4.86194	0.11095	0.99997	-0.00000
CL= 0.10									
0.10	0.16533	5.77103	-0.00999	0.01733	0.09991	6.81632	0.04504	0.99993	-0.00000
0.10	0.17905	5.24554	-0.03125	0.01906	0.31248	6.31207	0.04650	0.00008	-0.06366
0.20	0.17905	5.24550	-0.03125	0.01906	0.31250	6.31204	0.04650	0.00000	-0.06366
0.20	0.17914	5.51341	-0.01998	0.01814	0.19980	6.44414	0.06504	1.00000	0.00000
0.30	0.17905	5.24551	-0.03125	0.01906	0.31250	6.31202	0.04651	0.00012	-0.06365
0.30	0.18709	5.29363	-0.02997	0.01889	0.29970	6.19134	0.07503	0.99987	-0.00001
0.40	0.17905	5.24549	-0.03125	0.01906	0.31251	6.31201	0.04651	0.00007	-0.06366
0.40	0.19216	5.07440	-0.03996	0.01971	0.39959	5.97236	0.08201	0.99993	-0.00000
0.50	0.17905	5.24548	-0.03125	0.01906	0.31251	6.31201	0.04651	0.00005	-0.06366
0.50	0.19908	4.80126	-0.04995	0.02083	0.49948	5.72959	0.08832	0.99995	-0.00000
0.60	0.17905	5.24548	-0.03125	0.01906	0.31251	6.31200	0.04651	0.00004	-0.06366
0.60	0.20586	4.59019	-0.05994	0.02179	0.59939	5.48674	0.09521	0.99996	-0.00000
0.70	0.17905	5.24547	-0.03125	0.01906	0.31251	6.31200	0.04651	0.00003	-0.06366
0.70	0.21095	4.37061	-0.06993	0.02288	0.69929	5.26775	0.10134	0.99997	-0.00000
0.80	0.17905	5.24547	-0.03125	0.01906	0.31251	6.31200	0.04651	0.00003	-0.06366
0.80	0.21633	4.11080	-0.07992	0.02433	0.79918	5.01531	0.10657	0.99997	-0.00000
0.90	0.17905	5.24546	-0.03125	0.01906	0.31251	6.31200	0.04651	0.00002	-0.06366
0.90	0.22366	3.74269	-0.08991	0.02672	0.89909	4.64501	0.11368	0.99998	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.12

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.15678	6.79447	-0.01199	0.01766	0.09991	7.03368	0.03405	0.99994	-0.00000
0.10	0.17324	6.06858	-0.03750	0.01977	0.31249	6.42856	0.03580	0.00007	-0.07639
0.20	0.17324	6.06854	-0.03750	0.01977	0.31250	6.42853	0.03580	0.00000	-0.07639
0.20	0.17334	6.43622	-0.02398	0.01864	0.19980	6.58705	0.05805	1.00000	0.00000
0.30	0.17324	6.06855	-0.03750	0.01977	0.31250	6.42851	0.03581	0.00009	-0.07639
0.30	0.18289	6.13422	-0.03596	0.01956	0.29970	6.28368	0.07003	0.99990	-0.00001
0.40	0.17324	6.06853	-0.03750	0.01977	0.31250	6.42850	0.03581	0.00005	-0.07639
0.40	0.19017	5.83633	-0.04795	0.02056	0.39959	6.02091	0.07841	0.99994	-0.00000
0.50	0.17324	6.06851	-0.03750	0.01977	0.31251	6.42850	0.03581	0.00004	-0.07639
0.50	0.19727	5.46987	-0.05994	0.02194	0.49948	5.72959	0.08599	0.99996	-0.00000
0.60	0.17324	6.06851	-0.03750	0.01977	0.31251	6.42850	0.03581	0.00003	-0.07639
0.60	0.20541	5.19028	-0.07193	0.02312	0.59939	5.43816	0.09545	0.99997	-0.00000
0.70	0.17324	6.06851	-0.03750	0.01977	0.31251	6.42850	0.03581	0.00002	-0.07639
0.70	0.21152	4.90278	-0.08392	0.02448	0.69930	5.17538	0.10161	0.99997	-0.00000
0.80	0.17324	6.06850	-0.03750	0.01977	0.31251	6.42850	0.03581	0.00002	-0.07639
0.80	0.21797	4.56706	-0.09590	0.02623	0.79918	4.87244	0.10788	0.99998	-0.00000
0.90	0.17324	6.06850	-0.03750	0.01977	0.31251	6.42849	0.03581	0.00002	-0.07639
0.90	0.22677	4.09978	-0.10789	0.02927	0.89909	4.42810	0.11642	0.99998	-0.00000

CL= 0.14

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.14822	7.77860	-0.01399	0.01800	0.09991	7.25103	0.02306	0.99995	-0.00000
0.10	0.16743	6.83023	-0.04375	0.02050	0.31249	6.54506	0.02511	0.00005	-0.08912
0.20	0.16743	6.83018	-0.04375	0.02050	0.31250	6.54502	0.02511	0.00000	-0.08913
0.20	0.16754	7.30751	-0.02797	0.01916	0.19980	6.72996	0.05105	1.00000	0.00000
0.30	0.16743	6.83019	-0.04375	0.02050	0.31250	6.54500	0.02511	0.00008	-0.08912
0.30	0.17868	6.91499	-0.04196	0.02025	0.29969	6.37603	0.06504	0.99991	-0.00001
0.40	0.16743	6.83017	-0.04375	0.02050	0.31250	6.54499	0.02511	0.00005	-0.08912
0.40	0.18718	6.53194	-0.05594	0.02143	0.39959	6.06947	0.07482	0.99995	-0.00000
0.50	0.16743	6.83016	-0.04375	0.02050	0.31251	6.54498	0.02511	0.00003	-0.08912
0.50	0.19546	6.06646	-0.06993	0.02308	0.49948	5.72959	0.08365	0.99996	-0.00000
0.60	0.16743	6.83015	-0.04375	0.02050	0.31251	6.54498	0.02511	0.00003	-0.08912
0.60	0.20495	5.71560	-0.08392	0.02449	0.59939	5.38959	0.09469	0.99997	-0.00000
0.70	0.16743	6.83014	-0.04375	0.02050	0.31251	6.54499	0.02511	0.00002	-0.08912
0.70	0.21209	5.35874	-0.09790	0.02613	0.69930	5.08302	0.10187	0.99998	-0.00000
0.80	0.16743	6.83014	-0.04375	0.02050	0.31251	6.54498	0.02511	0.00002	-0.08913
0.80	0.21961	4.94715	-0.11189	0.02830	0.79919	4.72958	0.10919	0.99998	-0.00000
0.90	0.16743	6.83013	-0.04375	0.02050	0.31251	6.54498	0.02511	0.00002	-0.08913
0.90	0.22988	4.3[illegible]360	-0.12587	0.03194	0.89909	4.21118	0.11916	0.99998	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.13966	8.72506	-0.01599	0.01834	0.09991	7.46839	0.01207	0.99996	-0.00000
0.10	0.16161	7.53535	-0.05000	0.02123	0.31249	6.66155	0.01441	0.00005	-0.10185
0.20	0.16161	7.53529	-0.05000	0.02123	0.31250	6.66151	0.01441	0.00000	-0.10186
0.20	0.16175	8.13040	-0.03197	0.01968	0.19980	6.87286	0.04406	1.00000	0.00000
0.30	0.16162	7.53531	-0.05000	0.02123	0.31250	6.66149	0.01441	0.00008	-0.10185
0.30	0.17448	7.64048	-0.04795	0.02094	0.29969	6.46838	0.06004	0.99992	-0.00001
0.40	0.16162	7.53529	-0.05000	0.02123	0.31250	6.66148	0.01441	0.00004	-0.10185
0.40	0.18419	7.16733	-0.06393	0.02232	0.39959	6.11802	0.07122	0.99995	-0.00000
0.50	0.16162	7.53527	-0.05000	0.02123	0.31251	6.66148	0.01441	0.00003	-0.10186
0.50	0.19365	6.59905	-0.07992	0.02425	0.49948	5.72958	0.08131	0.99997	-0.00000
0.60	0.16162	7.53526	-0.05000	0.02123	0.31251	6.66148	0.01441	0.00002	-0.10186
0.60	0.20450	6.17563	-0.09590	0.02591	0.59939	5.34102	0.09394	0.99998	-0.00000
0.70	0.16162	7.53526	-0.05000	0.02123	0.31251	6.66143	0.01441	0.00002	-0.10186
0.70	0.21265	5.74941	-0.11189	0.02783	0.69930	4.99065	0.10214	0.99998	-0.00000
0.80	0.16162	7.53526	-0.05000	0.02123	0.31251	6.66147	0.01441	0.00002	-0.10186
0.80	0.22125	5.26346	-0.12787	0.03040	0.79919	4.58671	0.11051	0.99998	-0.00000
0.90	0.16162	7.53525	-0.05000	0.02123	0.31251	6.66147	0.01441	0.00001	-0.10186
0.90	0.23388	4.60811	-0.14386	0.03472	0.89910	3.98282	0.12183	0.99998	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.050 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
CL= 0.08												
0.10	0.15776	14.39622	-0.00799	0.00556	0.09990	3.69281	5.92701	0.01211	1.00000	0.00000	0.00414	-0.00103
0.10	0.17812	12.93969	-0.02520	0.00618	0.31504	3.30215	6.65538	0.01347	0.00000	-0.04565	0.00380	0.04471
0.20	0.17812	12.93967	-0.02520	0.00618	0.31504	3.30215	6.65539	0.01347	0.00000	-0.04565	0.00380	0.04471
0.20	0.17836	13.74179	-0.01598	0.00582	0.19980	3.40921	6.25200	0.02599	1.00000	0.00000	0.00271	-0.00035
0.30	0.17812	12.93967	-0.02520	0.00618	0.31504	3.30215	6.65539	0.01347	0.00000	-0.04565	0.00380	0.04471
0.30	0.19010	13.14780	-0.02398	0.00608	0.29969	3.21659	6.56223	0.03300	0.99998	-0.00000	0.00206	-0.00006
0.40	0.17812	12.93969	-0.02520	0.00618	0.31504	3.30215	6.65538	0.01347	-0.00000	-0.04565	0.00380	0.04471
0.40	0.19897	12.52338	-0.03197	0.00639	0.39959	3.04975	6.90698	0.03794	0.99998	-0.00000	0.00166	0.00010
0.50	0.17812	12.93967	-0.02520	0.00618	0.31504	3.30215	6.65539	0.01347	-0.00000	-0.04565	0.00380	0.04471
0.50	0.20749	11.70448	-0.03996	0.00683	0.49949	2.86478	7.39429	0.04246	0.99999	-0.00000	0.00136	0.00020
0.60	0.17812	12.93970	-0.02520	0.00618	0.31504	3.30215	6.65538	0.01347	0.00000	-0.04565	0.00380	0.04471
0.60	0.21744	11.09371	-0.04795	0.00721	0.59940	2.67975	7.81175	0.04813	1.00000	0.00000	0.00100	0.00034
0.70	0.17812	12.93969	-0.02520	0.00618	0.31504	3.30215	6.65538	0.01347	-0.00000	-0.04565	0.00380	0.04471
0.70	0.22480	10.44162	-0.05595	0.00766	0.69931	2.51285	8.29895	0.05187	1.00002	0.00000	0.00083	0.00033
0.80	0.17812	12.93969	-0.02520	0.00618	0.31504	3.30215	6.65538	0.01347	-0.00000	-0.04565	0.00380	0.04471
0.80	0.23251	9.65811	-0.06393	0.00828	0.79911	2.32004	8.95650	0.05572	0.99982	-0.00001	0.00070	0.00040
0.90	0.17812	12.93967	-0.02520	0.00618	0.31504	3.30215	6.65539	0.01347	0.00000	-0.04565	0.00380	0.04471
0.90	0.24275	8.52779	-0.07173	0.00938	0.89667	2.03437	10.07802	0.06105	0.99585	-0.00019	0.00058	0.00056
CL= 0.10												
0.10	0.14125	17.58537	-0.00999	0.00569	0.09990	3.89981	6.09137	0.00249	1.00000	0.00000	0.00503	-0.00125
0.10	0.16672	15.38792	-0.03149	0.00650	0.31489	3.41194	7.02811	0.00406	0.00001	-0.05726	0.00449	0.05615
0.20	0.16672	15.38787	-0.03149	0.00650	0.31490	3.41194	7.02812	0.00406	0.00000	-0.05726	0.00449	0.05615
0.20	0.16702	16.58482	-0.01998	0.00603	0.19980	3.54532	6.50801	0.01986	1.00000	0.00000	0.00325	-0.00042
0.30	0.16672	15.38789	-0.03149	0.00650	0.31490	3.41194	7.02811	0.00406	-0.00000	-0.05726	0.00449	0.05615
0.30	0.18172	15.69087	-0.02997	0.00637	0.29969	3.30454	6.90860	0.02862	0.99998	-0.00000	0.00244	-0.00007
0.40	0.16672	15.38788	-0.03149	0.00650	0.31490	3.41194	7.02812	0.00406	-0.00001	-0.05726	0.00449	0.05615
0.40	0.19283	14.76800	-0.03996	0.00677	0.39959	3.09599	7.35656	0.03480	0.99999	-0.00000	0.00195	0.00012
0.50	0.16672	15.38789	-0.03149	0.00650	0.31490	3.41194	7.02811	0.00406	0.00000	-0.05726	0.00449	0.05615
0.50	0.20353	13.58637	-0.04995	0.00736	0.49949	2.86478	7.99380	0.04045	0.99999	-0.00000	0.00158	0.00022
0.60	0.16672	15.38787	-0.03149	0.00650	0.31490	3.41194	7.02811	0.00406	-0.00000	-0.05726	0.00449	0.05615
0.60	0.21601	12.72075	-0.05994	0.00786	0.59940	2.63349	8.54406	0.04755	0.99999	-0.00000	0.00115	0.00038
0.70	0.16672	15.38788	-0.03149	0.00650	0.31490	3.41195	7.02812	0.00406	-0.00000	-0.05726	0.00449	0.05615
0.70	0.22526	11.81733	-0.06993	0.00846	0.69932	2.42493	9.18939	0.05223	1.00004	0.00000	0.00094	0.00042
0.80	0.16672	15.38789	-0.03149	0.00650	0.31489	3.41194	7.02812	0.00406	-0.00000	-0.05726	0.00449	0.05615
0.80	0.23496	10.76394	-0.07993	0.00929	0.79931	2.18460	10.06452	0.05706	1.00023	0.00001	0.00073	0.00041
0.90	0.16672	15.38786	-0.03149	0.00650	0.31490	3.41194	7.02812	0.00406	-0.00000	-0.05726	0.00449	0.05615
0.90	0.24806	9.30934	-0.08975	0.01074	0.89753	1.83057	11.54500	0.06368	0.99732	-0.00016	0.00064	0.00055

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.050 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
CL= 0.12												
0.20	0.15544	18.01404	-0.03387	0.00666	0.28228	3.56684	7.22932	0.00000	0.28290	-0.04936	0.00474	0.04830
0.20	0.15570	19.21107	-0.02398	0.00625	0.19980	3.68143	6.77157	0.01368	1.00000	0.00000	0.00374	-0.00049
0.30	0.15865	17.64183	-0.03744	0.00680	0.31200	3.49810	7.38765	0.00000	0.18359	-0.05626	0.00467	0.05521
0.30	0.17337	17.97456	-0.03596	0.00668	0.29969	3.39249	7.26764	0.02420	0.99999	-0.00000	0.00278	-0.00009
0.40	0.15997	17.44095	-0.03927	0.00688	0.32728	3.46585	7.47435	0.00000	0.14773	-0.05878	0.00464	0.05773
0.40	0.18673	16.72125	-0.04795	0.00718	0.39959	3.14223	7.82551	0.03162	0.99999	-0.00000	0.00220	0.00013
0.50	0.16089	17.24020	-0.04056	0.00696	0.33797	3.43934	7.56036	0.00000	0.12584	-0.06032	0.00461	0.05928
0.50	0.19961	15.15379	-0.05994	0.00792	0.49949	2.86478	8.62377	0.03840	0.99999	-0.00000	0.00175	0.00024
0.60	0.16158	17.14410	-0.04138	0.00700	0.34486	3.42308	7.60335	0.00000	0.10593	-0.06172	0.00460	0.06067
0.60	0.21463	14.02574	-0.07193	0.00856	0.59941	2.58722	9.31785	0.04695	1.00001	0.00000	0.00127	0.00041
0.70	0.16206	17.02963	-0.04220	0.00705	0.35170	3.40811	7.65399	0.00000	0.09624	-0.06241	0.00458	0.06137
0.70	0.22577	12.87293	-0.08392	0.00932	0.69930	2.33703	10.13604	0.05257	0.99998	-0.00000	0.00103	0.00045
0.80	0.16250	16.89287	-0.04289	0.00710	0.35744	3.39242	7.71452	0.00001	0.08827	-0.06299	0.00456	0.06195
0.80	0.23749	11.55611	-0.09591	0.01038	0.79928	2.04815	11.25179	0.05836	1.00018	0.00001	0.00085	0.00043
0.90	0.16304	16.69112	-0.04334	0.00719	0.36115	3.37122	7.80892	0.00004	0.07958	-0.06363	0.00452	0.06259
0.90	0.25350	9.81918	-0.10760	0.01222	0.89663	1.62698	13.13634	0.06604	0.99578	-0.00030	0.00069	0.00070
CL= 0.14												
0.20	0.14425	20.88887	-0.03335	0.00670	0.23821	3.75531	7.29551	0.00000	0.66603	-0.02683	0.00470	0.02599
0.20	0.14438	21.63181	-0.02797	0.00647	0.19980	3.81753	7.04271	0.00746	1.00000	0.00000	0.00418	-0.00054
0.30	0.15306	19.72408	-0.04315	0.00710	0.30820	3.56645	7.73903	-0.00000	0.43194	-0.04579	0.00454	0.04495
0.30	0.16503	20.01903	-0.04196	0.00699	0.29969	3.48044	7.63927	0.01974	0.99998	-0.00000	0.00309	-0.00010
0.40	0.15669	19.11899	-0.04818	0.00732	0.34413	3.47799	7.98582	0.00000	0.34746	-0.05269	0.00446	0.05185
0.40	0.18065	18.41399	-0.05594	0.00760	0.39959	3.18847	8.31374	0.02840	0.99999	-0.00000	0.00241	0.00014
0.50	0.15923	18.53244	-0.05170	0.00755	0.36925	3.40531	8.23309	0.00000	0.29588	-0.05695	0.00438	0.05611
0.50	0.19573	16.45160	-0.06993	0.00851	0.49949	2.86477	9.28396	0.03632	1.00000	-0.00000	0.00190	0.00026
0.60	0.16114	18.25648	-0.05396	0.00767	0.38544	3.36075	8.35775	-0.00000	0.24903	-0.06079	0.00435	0.05994
0.60	0.21330	15.06347	-0.08392	0.00929	0.59940	2.54096	10.13300	0.04632	0.99999	-0.00000	0.00137	0.00043
0.70	0.16247	17.93353	-0.05621	0.00781	0.40150	3.31976	8.50518	0.00000	0.22619	-0.06269	0.00431	0.06185
0.70	0.22635	13.67209	-0.09790	0.01024	0.69927	2.24906	11.13761	0.05288	0.99992	-0.00001	0.00110	0.00047
0.80	0.16368	17.55157	-0.05806	0.00798	0.41473	3.27657	8.68256	-0.00000	0.20694	-0.06431	0.00426	0.06347
0.80	0.24008	12.12022	-0.11189	0.01155	0.79921	1.91272	12.51369	0.05964	1.00004	0.00000	0.00090	0.00045
0.90	0.16521	17.01511	-0.05949	0.00823	0.42492	3.21814	8.95191	0.00022	0.18909	-0.06586	0.00417	0.06502
0.90	0.25850	10.15814	-0.12640	0.01378	0.90285	1.42706	14.88869	0.06925	1.00640	0.00053	0.00069	-0.00011

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.050 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.20	0.13307	23.72557	-0.03283	0.00674	0.20518	3.94367	7.36251	0.00000	0.95320	-0.00430	0.00467	0.00366
0.20	0.13309	23.85875	-0.03197	0.00671	0.19980	3.95364	7.32135	0.00120	1.00000	0.00000	0.00459	-0.00059
0.30	0.14750	21.60165	-0.04886	0.00741	0.30537	3.63472	8.10195	-0.00000	0.61783	-0.03530	0.00442	0.03464
0.30	0.15671	21.84410	-0.04795	0.00732	0.29969	3.56840	8.02345	0.01524	0.99999	-0.00000	0.00335	-0.00011
0.40	0.15345	20.54025	-0.05708	0.00779	0.35675	3.49019	8.51971	0.00000	0.49686	-0.04659	0.00429	0.04593
0.40	0.17460	19.87503	-0.06393	0.00805	0.39959	3.23471	8.82115	0.02516	0.99999	-0.00000	0.00260	0.00014
0.50	0.15760	19.54218	-0.06283	0.00819	0.39266	3.37152	8.94205	0.00000	0.42297	-0.05355	0.00418	0.05268
0.50	0.19189	17.51930	-0.07992	0.00913	0.49949	2.86478	9.97425	0.03421	0.99999	-0.00000	0.00203	0.00027
0.60	0.16075	19.08044	-0.06653	0.00839	0.41579	3.29879	9.15666	0.00000	0.35596	-0.05984	0.00413	0.05916
0.60	0.21201	15.88050	-0.09590	0.01008	0.59940	2.49471	10.98923	0.04567	1.00000	-0.00000	0.00144	0.00044
0.70	0.16293	18.54942	-0.07020	0.00863	0.43872	3.23192	9.41140	0.00000	0.32325	-0.06295	0.00406	0.06228
0.70	0.22698	14.26729	-0.11189	0.01121	0.69928	2.16109	12.19592	0.05318	0.99994	-0.00001	0.00115	0.00048
0.80	0.16490	17.93546	-0.07321	0.00892	0.45759	3.16185	9.71854	-0.00001	0.29565	-0.06561	0.00400	0.06493
0.80	0.24275	12.49967	-0.12787	0.01280	0.79920	1.77636	13.85259	0.06092	1.00000	0.00000	0.00093	0.00046
0.90	0.16721	17.08762	-0.07508	0.00936	0.46926	3.06976	10.16961	-0.00001	0.26521	-0.06858	0.00390	0.06788
0.90	0.26428	10.24180	-0.14352	0.01562	0.89697	1.20775	16.73389	0.07128	0.99637	-0.00034	0.00073	0.00074

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.050 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.17158	7.22308	-0.00799	0.01108	0.09990	5.12521	11.65160	0.03511	1.00002	0.00000	0.00203	-0.00049
0.10	0.18529	6.63726	-0.02510	0.01205	0.31378	4.73772	12.72585	0.03643	0.00001	-0.04704	0.00195	0.04656
0.20	0.18529	6.63725	-0.02510	0.01205	0.31378	4.73772	12.72585	0.03643	0.00000	-0.04704	0.00195	0.04656
0.20	0.18546	6.94941	-0.01598	0.01151	0.19980	4.84160	12.14196	0.04969	1.00000	0.00000	0.00136	-0.00017
0.30	0.18529	6.63725	-0.02510	0.01205	0.31378	4.73771	12.72586	0.03643	-0.00000	-0.04704	0.00195	0.04656
0.30	0.19341	6.70736	-0.02398	0.01193	0.29969	4.64899	12.60146	0.05701	0.99997	-0.00000	0.00106	-0.00004
0.40	0.18529	6.63726	-0.02510	0.01205	0.31378	4.73772	12.72586	0.03643	-0.00000	-0.04704	0.00195	0.04656
0.40	0.19945	6.45775	-0.03197	0.01239	0.39959	4.48214	13.10330	0.06215	0.99999	-0.00000	0.00087	0.00004
0.50	0.18529	6.63725	-0.02510	0.01205	0.31378	4.73772	12.72586	0.03643	-0.00001	-0.04704	0.00195	0.04656
0.50	0.20528	6.13532	-0.03996	0.01304	0.49949	4.29718	13.79885	0.06682	0.99999	-0.00000	0.00073	0.00009
0.60	0.18529	6.63725	-0.02510	0.01205	0.31378	4.73772	12.72586	0.03643	-0.00000	-0.04704	0.00195	0.04656
0.60	0.21204	5.88755	-0.04795	0.01359	0.59940	4.11214	14.39068	0.07266	1.00000	-0.00000	0.00056	0.00015
0.70	0.18529	6.63726	-0.02510	0.01205	0.31378	4.73772	12.72585	0.03643	0.00000	-0.04704	0.00195	0.04656
0.70	0.21707	5.62323	-0.05594	0.01423	0.69929	3.94526	15.07116	0.07648	0.99996	-0.00000	0.00047	0.00019
0.80	0.18529	6.63725	-0.02510	0.01205	0.31378	4.73772	12.72587	0.03643	0.00000	-0.04704	0.00195	0.04656
0.80	0.22232	5.30357	-0.06390	0.01508	0.79873	3.75315	15.97556	0.08037	0.99904	-0.00005	0.00041	0.00024
0.90	0.18529	6.63726	-0.02510	0.01205	0.31378	4.73772	12.72585	0.03643	0.00000	-0.04704	0.00195	0.04656
0.90	0.22924	4.84387	-0.07188	0.01652	0.89855	3.47407	17.46806	0.08557	0.99906	-0.00004	0.00035	0.00023

CL= 0.10

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.16066	8.85360	-0.00999	0.01129	0.09990	5.33220	11.90162	0.02508	1.00000	0.00000	0.00248	-0.00060
0.10	0.17780	7.97206	-0.03137	0.01254	0.31372	4.84804	13.26995	0.02668	0.00002	-0.05888	0.00233	0.05830
0.20	0.17780	7.97205	-0.03137	0.01254	0.31372	4.84803	13.26995	0.02668	0.00000	-0.05888	0.00233	0.05830
0.20	0.17801	8.43824	-0.01998	0.01185	0.19980	4.97771	12.52459	0.04331	1.00000	0.00000	0.00165	-0.00021
0.30	0.17780	7.97205	-0.03137	0.01254	0.31372	4.84802	13.26998	0.02668	-0.00001	-0.05888	0.00233	0.05830
0.30	0.18796	8.07542	-0.02997	0.01238	0.29969	4.73694	13.11131	0.05246	0.99998	-0.00000	0.00127	-0.00004
0.40	0.17780	7.97206	-0.03137	0.01254	0.31372	4.84802	13.26996	0.02663	0.00000	-0.05883	0.00233	0.05830
0.40	0.19551	7.70606	-0.03996	0.01298	0.39959	4.52833	13.75509	0.05889	0.99999	-0.00000	0.00104	0.00005
0.50	0.17780	7.97206	-0.03137	0.01254	0.31372	4.84802	13.26996	0.02668	0.00000	-0.05888	0.00233	0.05830
0.50	0.20282	7.23657	-0.04995	0.01382	0.49949	4.29713	14.65198	0.06473	0.99999	-0.00000	0.00087	0.00010
0.60	0.17780	7.97205	-0.03137	0.01254	0.31372	4.84803	13.26995	0.02668	-0.00000	-0.05888	0.00233	0.05830
0.60	0.21127	6.88091	-0.05994	0.01453	0.59940	4.06589	15.41949	0.07203	1.00001	0.00000	0.00065	0.00019
0.70	0.17780	7.97206	-0.03137	0.01254	0.31373	4.84803	13.26994	0.02668	0.00000	-0.05888	0.00233	0.05830
0.70	0.21757	6.50723	-0.06993	0.01537	0.69930	3.85730	16.30580	0.07681	1.00000	-0.00000	0.00055	0.00021
0.80	0.17780	7.97205	-0.03137	0.01254	0.31372	4.84803	13.26995	0.02668	-0.00000	-0.05888	0.00232	0.05830
0.80	0.22420	6.06382	-0.07992	0.01649	0.79920	3.61684	17.49063	0.08171	1.00002	0.00000	0.00047	0.00022
0.90	0.17780	7.97205	-0.03137	0.01254	0.31372	4.84803	13.26995	0.02668	-0.00000	-0.05883	0.00233	0.05830
0.90	0.23308	5.47203	-0.09075	0.01827	0.90748	3.27573	19.45685	0.08890	1.01430	0.00085	0.00037	-0.00063

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.050 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.12

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.14973	10.41876	-0.01199	0.01152	0.09990	5.53920	12.15498	0.01503	1.00000	0.00000	0.00291	-0.00070
0.10	0.17031	9.19636	-0.03764	0.01305	0.31367	4.95839	13.82751	0.01688	0.00001	-0.07074	0.00268	0.07008
0.20	0.17031	9.19634	-0.03764	0.01305	0.31367	4.95839	13.82753	0.01688	0.00000	-0.07074	0.00268	0.07008
0.20	0.17056	9.83792	-0.02398	0.01220	0.19980	5.11382	12.91446	0.03692	1.00000	0.00000	0.00192	-0.00024
0.30	0.17031	9.19632	-0.03764	0.01305	0.31367	4.95839	13.82755	0.01688	0.00000	-0.07074	0.00268	0.07008
0.30	0.18251	9.33685	-0.03596	0.01285	0.29969	4.82489	13.63336	0.04790	0.99998	-0.00000	0.00147	-0.00005
0.40	0.17031	9.19635	-0.03764	0.01305	0.31367	4.95838	13.82753	0.01688	-0.00001	-0.07074	0.00268	0.07008
0.40	0.19158	8.83320	-0.04795	0.01359	0.39959	4.57463	14.42564	0.05561	1.00000	-0.00000	0.00119	0.00005
0.50	0.17031	9.19634	-0.03764	0.01305	0.31367	4.95839	13.82754	0.01688	0.00000	-0.07074	0.00268	0.07008
0.50	0.20036	8.20299	-0.05994	0.01463	0.49949	4.29718	15.53476	0.06261	0.99999	-0.00000	0.00098	0.00011
0.60	0.17031	9.19633	-0.03764	0.01305	0.31367	4.95838	13.82754	0.01688	0.00000	-0.07074	0.00268	0.07008
0.60	0.21051	7.73199	-0.07193	0.01552	0.59940	4.01961	16.48901	0.07138	0.99998	-0.00000	0.00073	0.00021
0.70	0.17031	9.19636	-0.03764	0.01305	0.31367	4.95839	13.82753	0.01688	0.00000	-0.07074	0.00268	0.07008
0.70	0.21809	7.24422	-0.08392	0.01656	0.69930	3.76927	17.59586	0.07712	0.99998	-0.00000	0.00061	0.00023
0.80	0.17031	9.19636	-0.03764	0.01305	0.31367	4.95838	13.82750	0.01688	0.00000	-0.07074	0.00268	0.07008
0.80	0.22608	6.67484	-0.09595	0.01798	0.79954	3.48032	19.08208	0.08304	1.00071	0.00005	0.00051	0.00019
0.90	0.17031	9.19636	-0.03764	0.01305	0.31367	4.95838	13.82751	0.01688	0.00000	-0.07074	0.00268	0.07008
0.90	0.23704	5.90716	-0.10817	0.02031	0.90144	3.06218	21.55609	0.09115	1.00399	0.00029	0.00042	-0.00005

CL= 0.14

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.13881	11.92085	-0.01399	0.01174	0.09990	5.74622	12.41165	0.00497	1.00002	0.00000	0.00333	-0.00080
0.10	0.16282	10.31870	-0.04391	0.01357	0.31362	5.06882	14.39852	0.00706	0.00001	-0.08263	0.00300	0.08188
0.20	0.16282	10.31865	-0.04391	0.01357	0.31362	5.06880	14.39858	0.00706	0.00000	-0.08263	0.00300	0.08188
0.20	0.16312	11.15326	-0.02797	0.01255	0.19980	5.24992	13.31163	0.03050	1.00000	0.00000	0.00217	-0.00028
0.30	0.16282	10.31864	-0.04391	0.01357	0.31362	5.06880	14.39859	0.00706	-0.00002	-0.08263	0.00300	0.08188
0.30	0.17706	10.49928	-0.04196	0.01333	0.29969	4.91284	14.16755	0.04331	0.99998	-0.00000	0.00165	-0.00006
0.40	0.16282	10.31869	-0.04391	0.01357	0.31362	5.06880	14.39854	0.00706	0.00001	-0.08263	0.00300	0.08188
0.40	0.18765	9.85013	-0.05594	0.01421	0.39959	4.62086	15.11491	0.05231	0.99999	-0.00000	0.00132	0.00006
0.50	0.16282	10.31866	-0.04391	0.01357	0.31362	5.06880	14.39855	0.00706	-0.00000	-0.08263	0.00300	0.08188
0.50	0.19792	9.05015	-0.06993	0.01547	0.49949	4.29717	16.44708	0.06048	0.99999	-0.00000	0.00108	0.00013
0.60	0.16282	10.31866	-0.04391	0.01357	0.31362	5.06880	14.39856	0.00706	-0.00000	-0.08263	0.00300	0.08188
0.60	0.20978	8.46025	-0.08392	0.01655	0.59940	3.97335	17.59901	0.07073	1.00000	0.00000	0.00080	0.00022
0.70	0.16282	10.31865	-0.04391	0.01357	0.31362	5.06880	14.39857	0.00706	-0.00000	-0.08263	0.00300	0.08188
0.70	0.21863	7.85807	-0.09790	0.01782	0.69930	3.68146	18.93971	0.07742	0.99999	-0.00000	0.00066	0.00025
0.80	0.16282	10.31866	-0.04391	0.01357	0.31362	5.06880	14.39855	0.00706	-0.00000	-0.08263	0.00300	0.08188
0.80	0.22795	7.16384	-0.11186	0.01954	0.79900	3.34434	20.74829	0.08427	0.99961	-0.00003	0.00056	0.00029
0.90	0.16282	10.31865	-0.04391	0.01357	0.31362	5.06880	14.39857	0.00706	-0.00000	-0.08263	0.00300	0.08188
0.90	0.24072	6.23483	-0.12651	0.02245	0.90367	2.84980	23.86685	0.09418	1.00780	0.00065	0.00044	-0.00041

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.050 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.20	0.15537	11.44928	-0.04828	0.01397	0.30177	5.20068	14.84863	0.00000	0.10383	-0.08470	0.00321	0.08393
0.20	0.15568	12.38884	-0.03197	0.01291	0.19980	5.38603	13.71603	0.02407	1.00000	0.00000	0.00240	-0.00031
0.30	0.15643	11.36178	-0.05002	0.01408	0.31264	5.16722	14.96430	-0.00000	0.06740	-0.08816	0.00320	0.08739
0.30	0.17163	11.56987	-0.04795	0.01383	0.29969	5.00079	14.71392	0.03872	0.99999	-0.00000	0.00181	-0.00006
0.40	0.15687	11.31456	-0.05092	0.01414	0.31824	5.15152	15.02779	-0.00000	0.05419	-0.08942	0.00319	0.08865
0.40	0.18374	10.76695	-0.06393	0.01486	0.39959	4.66710	15.82280	0.04900	0.99999	-0.00000	0.00145	0.00006
0.50	0.15718	11.26812	-0.05154	0.01420	0.32214	5.13866	15.08943	-0.00000	0.04609	-0.09020	0.00318	0.08943
0.50	0.19548	9.79193	-0.07992	0.01634	0.49949	4.29717	17.38882	0.05834	1.00000	-0.00000	0.00117	0.00013
0.60	0.15741	11.24527	-0.05194	0.01423	0.32465	5.13075	15.12030	-0.00000	0.03878	-0.09089	0.00318	0.09012
0.60	0.20905	9.08194	-0.09590	0.01762	0.59939	3.92708	18.74940	0.07006	0.99997	-0.00000	0.00086	0.00024
0.70	0.15757	11.21854	-0.05234	0.01426	0.32715	5.12351	15.15618	0.00000	0.03521	-0.09123	0.00317	0.09047
0.70	0.21918	8.36706	-0.11189	0.01912	0.69933	3.59352	20.33885	0.07772	1.00006	0.00001	0.00071	0.00026
0.80	0.15772	11.18653	-0.05267	0.01430	0.32917	5.11594	15.19873	-0.00000	0.03214	-0.09153	0.00317	0.09076
0.80	0.22987	7.55562	-0.12788	0.02118	0.79923	3.20851	22.49103	0.08556	1.00006	0.00001	0.00059	0.00026
0.90	0.15788	11.14187	-0.05286	0.01436	0.33035	5.10644	15.25864	-0.00001	0.02868	-0.09187	0.00316	0.09110
0.90	0.24415	6.48904	-0.14357	0.02466	0.89732	2.65142	26.18759	0.09610	0.99696	-0.00029	0.00047	0.00053

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.050 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
CL= 0.08												
0.10	0.17952	4.29325	-0.00799	0.01863	0.09990	6.55760	19.52124	0.05929	1.00001	0.00000	0.00119	-0.00029
0.10	0.18984	4.00967	-0.02506	0.01995	0.31326	6.17143	20.93884	0.06057	0.00003	-0.04762	0.00117	0.04733
0.20	0.18984	4.00967	-0.02506	0.01995	0.31326	6.17143	20.93887	0.06057	0.00000	-0.04762	0.00117	0.04733
0.20	0.18997	4.15943	-0.01598	0.01923	0.19980	6.27400	20.17441	0.07415	1.00000	0.00000	0.00081	-0.00010
0.30	0.18984	4.00967	-0.02506	0.01995	0.31326	6.17142	20.93889	0.06057	-0.00002	-0.04763	0.00117	0.04733
0.30	0.19598	4.04134	-0.02398	0.01980	0.29969	6.08139	20.78131	0.08159	0.99997	-0.00000	0.00064	-0.00002
0.40	0.18984	4.00967	-0.02506	0.01995	0.31326	6.17141	20.93889	0.06057	-0.00002	-0.04762	0.00117	0.04733
0.40	0.20054	3.91971	-0.03197	0.02041	0.39959	5.91455	21.43887	0.08681	0.99998	-0.00000	0.00053	0.00002
0.50	0.18984	4.00967	-0.02506	0.01995	0.31326	6.17141	20.93884	0.06057	0.00001	-0.04762	0.00117	0.04733
0.50	0.20497	3.76253	-0.03996	0.02126	0.49948	5.72958	22.34186	0.09154	0.99998	-0.00000	0.00046	0.00005
0.60	0.18984	4.00967	-0.02506	0.01995	0.31326	6.17142	20.93887	0.06057	-0.00001	-0.04762	0.00117	0.04733
0.60	0.21007	3.63959	-0.04795	0.02198	0.59940	5.54454	23.10704	0.09745	1.00000	0.00000	0.00035	0.00009
0.70	0.18984	4.00966	-0.02506	0.01995	0.31326	6.17141	20.93889	0.06057	-0.00001	-0.04762	0.00117	0.04733
0.70	0.21389	3.50788	-0.05594	0.02281	0.69930	5.37769	23.98021	0.10130	0.99998	-0.00000	0.00030	0.00011
0.80	0.18984	4.00967	-0.02506	0.01995	0.31326	6.17141	20.93889	0.06057	-0.00001	-0.04762	0.00117	0.04733
0.80	0.21789	3.34781	-0.06397	0.02390	0.79960	5.18560	25.13002	0.10527	1.00082	0.00004	0.00026	0.00008
0.90	0.18984	4.00967	-0.02506	0.01995	0.31326	6.17142	20.93887	0.06057	-0.00000	-0.04762	0.00117	0.04733
0.90	0.22304	3.11037	-0.07152	0.02572	0.89402	4.90757	27.03729	0.11050	0.99134	-0.00041	0.00023	0.00053
CL= 0.10												
0.10	0.17135	5.28037	-0.00999	0.01894	0.09990	6.76461	19.85530	0.04909	1.00002	0.00000	0.00147	-0.00035
0.10	0.18425	4.85176	-0.03132	0.02061	0.31324	6.28197	21.65250	0.05065	-0.00000	-0.05957	0.00142	0.05921
0.20	0.18425	4.85175	-0.03132	0.02061	0.31324	6.28196	21.65254	0.05065	0.00000	-0.05957	0.00142	0.05921
0.20	0.18442	5.07677	-0.01998	0.01970	0.19980	6.41011	20.68152	0.06766	1.00000	0.00000	0.00099	-0.00013
0.30	0.18425	4.85175	-0.03132	0.02061	0.31324	6.28195	21.65254	0.05065	-0.00003	-0.05957	0.00142	0.05922
0.30	0.19193	4.89896	-0.02997	0.02041	0.29969	6.16933	21.45232	0.07696	0.99997	-0.00000	0.00077	-0.00003
0.40	0.18425	4.85175	-0.03132	0.02061	0.31324	6.28195	21.65254	0.05065	-0.00000	-0.05957	0.00142	0.05921
0.40	0.19764	4.71769	-0.03996	0.02120	0.39959	5.96078	22.29051	0.08349	0.99998	-0.00000	0.00064	0.00003
0.50	0.18425	4.85175	-0.03132	0.02061	0.31324	6.28195	21.65253	0.05065	0.00001	-0.05957	0.00142	0.05921
0.50	0.20318	4.48639	-0.04995	0.02229	0.49949	5.72957	23.44635	0.08940	0.99999	-0.00000	0.00054	0.00006
0.60	0.18425	4.85176	-0.03132	0.02061	0.31324	6.28195	21.65251	0.05065	0.00001	-0.05957	0.00142	0.05921
0.60	0.20956	4.30758	-0.05994	0.02321	0.59940	5.49828	24.43031	0.09678	1.00000	0.00000	0.00041	0.00011
0.70	0.18425	4.85176	-0.03132	0.02061	0.31324	6.28196	21.65250	0.05065	0.00001	-0.05957	0.00142	0.05921
0.70	0.21433	4.11836	-0.06993	0.02428	0.69932	5.28974	25.55692	0.10161	1.00003	0.00000	0.00035	0.00013
0.80	0.18425	4.85175	-0.03132	0.02061	0.31323	6.28195	21.65256	0.05065	-0.00001	-0.05957	0.00142	0.05921
0.80	0.21936	3.89082	-0.07992	0.02570	0.79919	5.04926	27.04939	0.10654	0.99998	-0.00000	0.00031	0.00014
0.90	0.18425	4.85175	-0.03132	0.02061	0.31324	6.28196	21.65256	0.05065	0.00000	-0.05957	0.00142	0.05921
0.90	0.22581	3.57675	-0.08977	0.02796	0.89774	4.71243	29.50830	0.11311	0.99768	-0.00014	0.00026	0.00027

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.050 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.12

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.16318	6.23520	-0.01199	0.01925	0.09990	6.97161	20.19263	0.03888	1.00000	-0.00000	0.00173	-0.00041
0.10	0.17866	5.63807	-0.03759	0.02128	0.31321	6.39252	22.37941	0.04072	-0.00001	-0.07152	0.00164	0.07111
0.20	0.17867	5.63806	-0.03759	0.02128	0.31321	6.39252	22.37944	0.04072	0.00000	-0.07152	0.00164	0.07111
0.20	0.17887	5.94970	-0.02398	0.02017	0.19980	6.54621	21.19580	0.06116	1.00000	0.00000	0.00116	-0.00015
0.30	0.17866	5.63805	-0.03759	0.02128	0.31321	6.39253	22.37944	0.04072	-0.00001	-0.07152	0.00164	0.07111
0.30	0.18788	5.70292	-0.03596	0.02104	0.29969	6.25728	22.13527	0.07233	0.99998	-0.00000	0.00090	-0.00003
0.40	0.17866	5.63807	-0.03759	0.02128	0.31321	6.39253	22.37941	0.04072	-0.00000	-0.07152	0.00164	0.07111
0.40	0.19474	5.45387	-0.04795	0.02200	0.39959	6.00702	23.16058	0.08015	0.99999	-0.00000	0.00074	0.00003
0.50	0.17866	5.63807	-0.03759	0.02128	0.31322	6.39253	22.37941	0.04072	0.00002	-0.07152	0.00164	0.07111
0.50	0.20139	5.13996	-0.05994	0.02335	0.49949	5.72957	24.58009	0.08725	0.99999	-0.00000	0.00062	0.00007
0.60	0.17866	5.63805	-0.03759	0.02128	0.31321	6.39252	22.37946	0.04072	0.00000	-0.07152	0.00164	0.07111
0.60	0.20905	4.90002	-0.07193	0.02449	0.59940	5.45201	25.79373	0.09611	1.00000	-0.00000	0.00047	0.00013
0.70	0.17866	5.63805	-0.03759	0.02128	0.31321	6.39252	22.37947	0.04072	0.00000	-0.07152	0.00164	0.07111
0.70	0.21478	4.64882	-0.08391	0.02581	0.69925	5.20172	27.18867	0.10190	0.99985	-0.00001	0.00040	0.00015
0.80	0.17866	5.63807	-0.03759	0.02128	0.31321	6.39254	22.37941	0.04072	-0.00000	-0.07152	0.00164	0.07111
0.80	0.22031	4.35047	-0.09587	0.02758	0.79889	4.91308	29.04251	0.10779	0.99938	-0.00004	0.00034	0.00019
0.90	0.17866	5.63804	-0.03759	0.02128	0.31321	6.39252	22.37949	0.04072	-0.00001	-0.07152	0.00164	0.07111
0.90	0.22912	3.91851	-0.10710	0.03062	0.89254	4.48336	32.17581	0.11531	0.98881	-0.00080	0.00030	0.00094

CL= 0.14

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.15502	7.15872	-0.01399	0.01956	0.09990	7.17861	20.53328	0.02865	1.00000	0.00000	0.00199	-0.00047
0.10	0.17308	6.37226	-0.04385	0.02197	0.31319	6.50315	23.11958	0.03077	0.00002	-0.08349	0.00186	0.08302
0.20	0.17308	6.37226	-0.04385	0.02197	0.31319	6.50313	23.11958	0.03077	0.00000	-0.08349	0.00186	0.08303
0.20	0.17332	6.78033	-0.02797	0.02065	0.19980	6.68232	21.71719	0.05466	1.00000	0.00000	0.00132	-0.00017
0.30	0.17308	6.37226	-0.04385	0.02197	0.31319	6.50312	23.11961	0.03077	-0.00002	-0.08349	0.00186	0.08303
0.30	0.18384	6.45655	-0.04196	0.02168	0.29969	6.34524	22.83014	0.06769	1.00000	0.00000	0.00102	-0.00004
0.40	0.17308	6.37227	-0.04385	0.02197	0.31319	6.50313	23.11955	0.03077	-0.00001	-0.08349	0.00186	0.08303
0.40	0.19184	6.13301	-0.05594	0.02283	0.39959	6.05327	24.04901	0.07681	0.99999	-0.00000	0.00083	0.00003
0.50	0.17308	6.37227	-0.04385	0.02197	0.31319	6.50313	23.11957	0.03077	0.00001	-0.08349	0.00186	0.08303
0.50	0.19960	5.73003	-0.06993	0.02443	0.49949	5.72956	25.74298	0.08509	0.99999	-0.00000	0.00069	0.00007
0.60	0.17308	6.37226	-0.04385	0.02197	0.31319	6.50313	23.11961	0.03077	-0.00001	-0.08349	0.00186	0.08303
0.60	0.20855	5.42541	-0.08392	0.02580	0.59940	5.40574	27.19736	0.09544	0.99999	-0.00000	0.00052	0.00014
0.70	0.17308	6.37225	-0.04385	0.02197	0.31319	6.50313	23.11961	0.03077	0.00000	-0.08349	0.00186	0.08303
0.70	0.21525	5.11008	-0.09790	0.02740	0.69930	5.11373	28.87448	0.10219	0.99999	-0.00000	0.00044	0.00016
0.80	0.17308	6.37225	-0.04385	0.02197	0.31319	6.50311	23.11960	0.03077	-0.00001	-0.08349	0.00186	0.08303
0.80	0.22230	4.74102	-0.11189	0.02953	0.79922	4.77720	31.11230	0.10910	1.00004	0.00000	0.00037	0.00016
0.90	0.17308	6.37225	-0.04385	0.02197	0.31319	6.50312	23.11963	0.03077	-0.00001	-0.08349	0.00186	0.08303
0.90	0.23173	4.22155	-0.12547	0.03316	0.89618	4.28314	34.79350	0.11813	0.99502	-0.00042	0.00032	0.00057

AD-A044 784 PENNSYLVANIA STATE UNIV UNIVERSITY PARK APPLIED RESE--ETC F/G 20/4
A THIRD PROCEDURE FOR LINEARIZED FULLY CAVITATING HYDROFOIL SEC--ETC(U)
JUL 77 B R PARKIN, J FERNANDEZ N00017-73-C-1418

UNCLASSIFIED TM-77-186 NL

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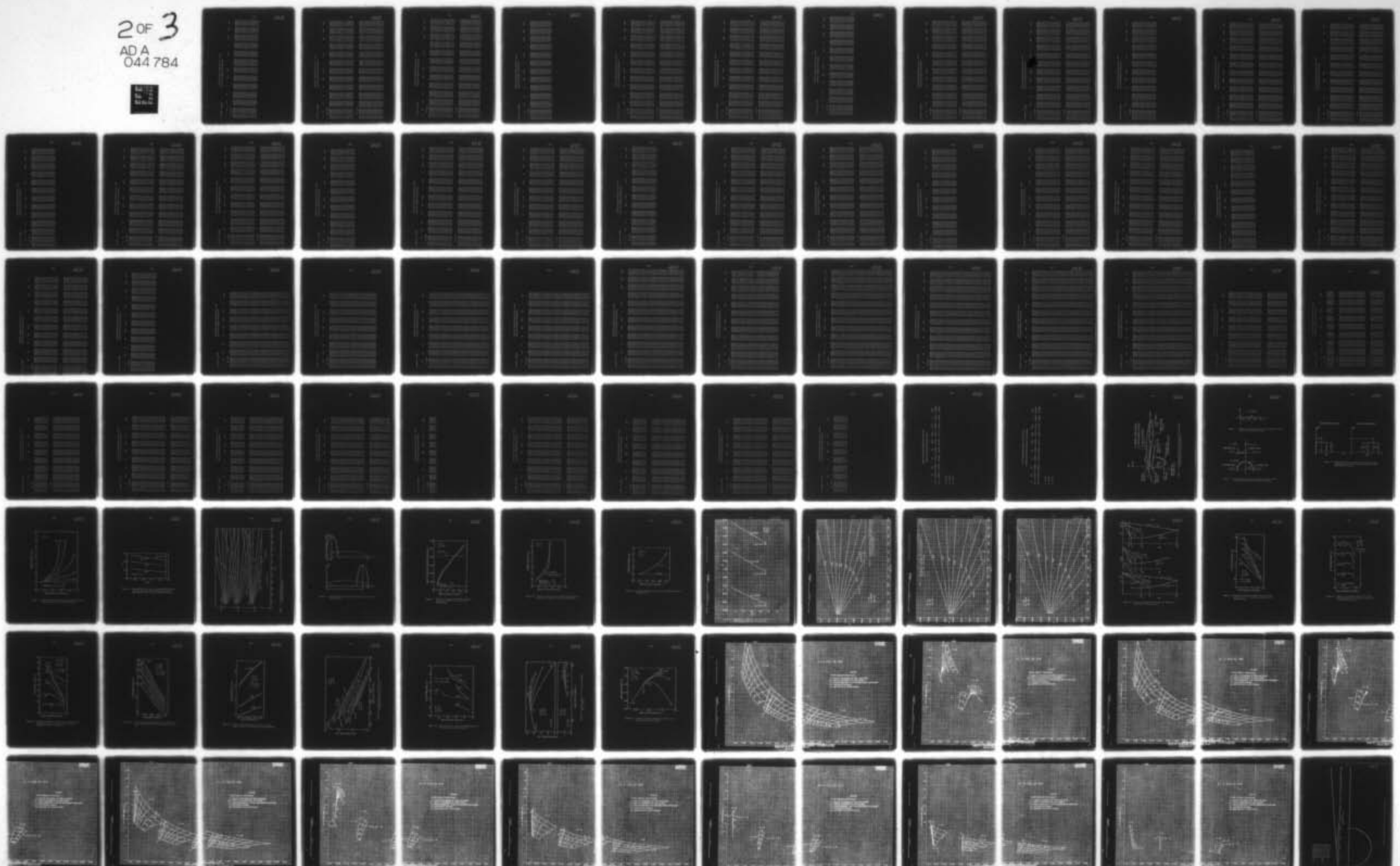


THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.050 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.14685	8.05202	-0.01598	0.01987	0.09990	7.38563	20.87700	0.01843	1.00001	0.00000	0.00223	-0.00053
0.10	0.16750	7.05779	-0.05011	0.02267	0.31317	6.61374	23.87297	0.02081	0.00000	-0.09547	0.00205	0.09495
0.20	0.16750	7.05780	-0.05011	0.02267	0.31317	6.61375	23.87299	0.02081	0.00000	-0.09547	0.00205	0.09496
0.20	0.16777	7.57070	-0.03197	0.02113	0.19980	6.81843	22.24571	0.04315	1.00000	0.00000	0.00147	-0.00019
0.30	0.16750	7.05778	-0.05011	0.02267	0.31317	6.61375	23.87302	0.02081	0.00001	-0.09547	0.00205	0.09495
0.30	0.17980	7.16293	-0.04795	0.02234	0.29969	6.43318	23.53705	0.06303	0.99999	-0.00000	0.00113	-0.00004
0.40	0.16750	7.05778	-0.05011	0.02267	0.31317	6.61374	23.87302	0.02081	0.00001	-0.09547	0.00205	0.09495
0.40	0.18894	6.75947	-0.06393	0.02367	0.39959	6.09950	24.95587	0.07347	1.00000	-0.00000	0.00092	0.00004
0.50	0.16750	7.05778	-0.05011	0.02267	0.31317	6.61374	23.87305	0.02081	-0.00001	-0.09547	0.00205	0.09496
0.50	0.19782	6.25270	-0.07992	0.02555	0.49949	5.72957	26.93506	0.08292	0.99999	-0.00000	0.00076	0.00008
0.60	0.16750	7.05778	-0.05011	0.02267	0.31317	6.61374	23.87305	0.02081	-0.00001	-0.09547	0.00205	0.09496
0.60	0.20806	5.89118	-0.09590	0.02716	0.59940	5.35949	28.64075	0.09475	0.99999	-0.00000	0.00057	0.00015
0.70	0.16750	7.05777	-0.05011	0.02267	0.31317	6.61373	23.87303	0.02081	0.00000	-0.09547	0.00205	0.09495
0.70	0.21571	5.51071	-0.11189	0.02903	0.69932	5.02579	30.61465	0.10248	1.00002	0.00000	0.00047	0.00017
0.80	0.16750	7.05777	-0.05011	0.02267	0.31317	6.61374	23.87305	0.02081	0.00000	-0.09547	0.00205	0.09495
0.80	0.22380	5.06961	-0.12789	0.03156	0.79929	4.64038	33.26001	0.11039	1.00020	0.00002	0.00040	0.00015
0.90	0.16750	7.05778	-0.05011	0.02267	0.31317	6.61374	23.87302	0.02081	0.00001	-0.09547	0.00205	0.09495
0.90	0.23450	4.45545	-0.14254	0.03591	0.89086	4.07688	37.67241	0.12018	0.98594	-0.00135	0.00035	0.00151

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.100 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
CL= 0.08												
0.10	0.19630	9.78810	-0.00799	0.00817	0.09990	3.65517	2.28544	0.02063	1.00000	-0.00000	0.01204	-0.00337
0.10	0.21506	9.38351	-0.02565	0.00853	0.32063	3.26909	2.45442	0.02253	0.00000	-0.03821	0.01084	0.03555
0.20	0.21506	9.38347	-0.02565	0.00853	0.32063	3.26908	2.45443	0.02253	0.00000	-0.03821	0.01084	0.03555
0.20	0.21524	9.66686	-0.01598	0.00828	0.19980	3.38447	2.35571	0.03160	1.00000	0.00000	0.00771	-0.00117
0.30	0.21506	9.38347	-0.02565	0.00853	0.32063	3.26908	2.45443	0.02253	-0.00001	-0.03821	0.01084	0.03555
0.30	0.22579	9.51646	-0.02398	0.00841	0.29969	3.20060	2.42458	0.03724	0.99998	-0.00000	0.00570	-0.00011
0.40	0.21506	9.38348	-0.02565	0.00853	0.32063	3.26908	2.45443	0.02253	0.00000	-0.03821	0.01084	0.03555
0.40	0.23356	9.31028	-0.03197	0.00859	0.39959	3.04134	2.50344	0.04130	0.99999	-0.00000	0.00444	0.00055
0.50	0.21506	9.38347	-0.02565	0.00853	0.32063	3.26907	2.45443	0.02253	-0.00000	-0.03821	0.01084	0.03555
0.50	0.24075	8.95265	-0.03996	0.00894	0.49949	2.86478	2.61952	0.04514	0.99999	-0.00000	0.00352	0.00101
0.60	0.21506	9.38348	-0.02565	0.00853	0.32063	3.26908	2.45443	0.02253	0.00000	-0.03821	0.01084	0.03555
0.60	0.24952	8.69130	-0.04795	0.00920	0.59940	2.68815	2.71701	0.04989	0.99999	-0.00000	0.00237	0.00157
0.70	0.21506	9.38348	-0.02565	0.00853	0.32063	3.26908	2.45443	0.02253	0.00000	-0.03821	0.01084	0.03555
0.70	0.25574	8.36289	-0.05594	0.00957	0.69923	2.52884	2.83363	0.05316	0.99980	-0.00001	0.00183	0.00182
0.80	0.21506	9.38349	-0.02565	0.00853	0.32063	3.26908	2.45443	0.02253	0.00000	-0.03821	0.01084	0.03555
0.80	0.26203	7.91369	-0.06390	0.01011	0.79876	2.34607	2.99377	0.05659	0.99910	-0.00004	0.00146	0.00195
0.90	0.21506	9.38351	-0.02565	0.00853	0.32063	3.26909	2.45443	0.02253	0.00000	-0.03821	0.01084	0.03555
0.90	0.27011	7.19597	-0.07192	0.01112	0.89898	2.07914	3.27388	0.06152	0.99980	-0.00001	0.00117	0.00186
CL= 0.10												
0.10	0.18016	12.17490	-0.00999	0.00821	0.09990	3.85278	2.32027	0.01306	0.99999	-0.00000	0.01475	-0.00412
0.10	0.20363	11.50096	-0.03203	0.00869	0.32028	3.37116	2.53825	0.01516	0.00001	-0.04815	0.01302	0.04495
0.20	0.20363	11.50091	-0.03203	0.00869	0.32028	3.37115	2.53826	0.01516	0.00000	-0.04815	0.01302	0.04495
0.20	0.20387	11.96558	-0.01998	0.00836	0.19980	3.51438	2.41070	0.02679	1.00000	0.00000	0.00936	-0.00141
0.30	0.20363	11.50092	-0.03203	0.00869	0.32028	3.37115	2.53826	0.01516	-0.00000	-0.04815	0.01302	0.04495
0.30	0.21710	11.70952	-0.02997	0.00854	0.29969	3.28455	2.50006	0.03383	0.99999	-0.00000	0.00688	-0.00014
0.40	0.20363	11.50095	-0.03203	0.00869	0.32028	3.37116	2.53825	0.01516	0.00000	-0.04815	0.01302	0.04495
0.40	0.22685	11.36594	-0.03996	0.00880	0.39959	3.08548	2.60307	0.03891	0.99999	-0.00000	0.00533	0.00064
0.50	0.20363	11.50091	-0.03203	0.00869	0.32028	3.37115	2.53826	0.01516	-0.00000	-0.04815	0.01302	0.04495
0.50	0.23594	10.79131	-0.04995	0.00927	0.49949	2.86478	2.75559	0.04370	1.00000	-0.00000	0.00420	0.00114
0.60	0.20363	11.50094	-0.03203	0.00869	0.32029	3.37115	2.53825	0.01516	0.00000	-0.04815	0.01302	0.04495
0.60	0.24697	10.37080	-0.05994	0.00964	0.59940	2.64400	2.88494	0.04969	1.00001	0.00000	0.00284	0.00177
0.70	0.20363	11.50095	-0.03203	0.00869	0.32028	3.37115	2.53825	0.01516	-0.00000	-0.04815	0.01302	0.04495
0.70	0.25485	9.85839	-0.06992	0.01014	0.69924	2.44480	3.04048	0.05379	0.99983	-0.00001	0.00220	0.00201
0.80	0.20363	11.50094	-0.03203	0.00869	0.32029	3.37115	2.53825	0.01516	0.00000	-0.04815	0.01302	0.04495
0.80	0.26294	9.17956	-0.07991	0.01089	0.79910	2.21520	3.25550	0.05812	0.99980	-0.00001	0.00177	0.00207
0.90	0.20363	11.50097	-0.03203	0.00869	0.32029	3.37116	2.53825	0.01516	0.00000	-0.04815	0.01302	0.04495
0.90	0.27379	8.15756	-0.09022	0.01226	0.90216	1.87973	3.62764	0.06437	1.00526	0.00027	0.00139	0.00169

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.100 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
CL= 0.12												
0.10	0.16404	14.52913	-0.01199	0.00826	0.09990	4.05037	2.35596	0.00540	0.99999	-0.00000	0.01735	-0.00483
0.10	0.19222	13.50632	-0.03839	0.00888	0.31995	3.47359	2.62565	0.00760	0.00001	-0.05823	0.01502	0.05454
0.20	0.19222	13.50628	-0.03839	0.00888	0.31996	3.47358	2.62565	0.00760	0.00000	-0.05823	0.01502	0.05454
0.20	0.19252	14.20124	-0.02398	0.00845	0.19980	3.64430	2.46758	0.02188	1.00000	0.00000	0.01092	-0.00163
0.30	0.19222	13.50625	-0.03839	0.00888	0.31996	3.47358	2.62565	0.00760	-0.00000	-0.05823	0.01502	0.05454
0.30	0.20844	13.80557	-0.03596	0.00869	0.29969	3.36851	2.57877	0.03035	0.99999	-0.00000	0.00797	-0.00016
0.40	0.19222	13.50628	-0.03839	0.00883	0.31996	3.47358	2.62565	0.00760	0.00000	-0.05823	0.01502	0.05454
0.40	0.22020	13.28640	-0.04795	0.00903	0.39959	3.12963	2.70774	0.03645	0.99999	-0.00000	0.00614	0.00072
0.50	0.19222	13.50630	-0.03839	0.00888	0.31996	3.47358	2.62565	0.00760	0.00000	-0.05823	0.01502	0.05454
0.50	0.23120	12.44775	-0.05994	0.00964	0.49949	2.86478	2.89967	0.04219	0.99999	-0.00000	0.00481	0.00125
0.60	0.19222	13.50626	-0.03839	0.00888	0.31995	3.47358	2.62565	0.00760	-0.00000	-0.05823	0.01502	0.05454
0.60	0.24453	11.83762	-0.07193	0.01014	0.59940	2.59983	3.06390	0.04943	1.00001	0.00000	0.00325	0.00192
0.70	0.19222	13.50630	-0.03839	0.00888	0.31996	3.47357	2.62565	0.00760	0.00000	-0.05823	0.01502	0.05454
0.70	0.25409	11.11714	-0.08391	0.01079	0.69926	2.36101	3.26204	0.05437	0.99987	-0.00001	0.00253	0.00214
0.80	0.19222	13.50630	-0.03839	0.00888	0.31996	3.47357	2.62565	0.00760	0.00000	-0.05823	0.01502	0.05454
0.80	0.26395	10.19247	-0.09590	0.01177	0.79914	2.08544	3.53770	0.05958	0.99988	-0.00001	0.00204	0.00216
0.90	0.19222	13.50632	-0.03840	0.00888	0.31996	3.47358	2.62565	0.00760	0.00001	-0.05823	0.01502	0.05454
0.90	0.27705	8.86597	-0.10737	0.01353	0.89476	1.69319	3.99477	0.06645	0.99254	-0.00047	0.00170	0.00242
CL= 0.14												
0.20	0.18083	15.40106	-0.04462	0.00909	0.31874	3.57779	2.71516	0.00000	0.00753	-0.06791	0.01681	0.06379
0.20	0.18119	16.36736	-0.02797	0.00855	0.19980	3.77422	2.52637	0.01690	1.00000	0.00000	0.01238	-0.00183
0.30	0.18092	15.39561	-0.04474	0.00909	0.31954	3.57572	2.71637	-0.00000	0.00486	-0.06810	0.01680	0.06398
0.30	0.19981	15.79698	-0.04196	0.00886	0.29969	3.45246	2.66075	0.02678	0.99999	-0.00000	0.00897	-0.00018
0.40	0.18096	15.39251	-0.04479	0.00910	0.31995	3.57475	2.71702	0.00000	0.00393	-0.06817	0.01680	0.06405
0.40	0.21360	15.06524	-0.05594	0.00929	0.39959	3.17376	2.81749	0.03391	0.99999	-0.00000	0.00688	0.00078
0.50	0.18098	15.38884	-0.04483	0.00910	0.32024	3.57395	2.71770	0.00000	0.00337	-0.06821	0.01679	0.06409
0.50	0.22654	13.92309	-0.06993	0.01006	0.49949	2.86478	3.05176	0.04061	0.99999	-0.00000	0.00535	0.00133
0.60	0.18100	15.38722	-0.04486	0.00910	0.32043	3.57344	2.71803	0.00000	0.00284	-0.06825	0.01679	0.06413
0.60	0.24220	13.10019	-0.08392	0.01069	0.59940	2.55568	3.25380	0.04911	0.99999	-0.00000	0.00362	0.00202
0.70	0.18101	15.38512	-0.04489	0.00910	0.32062	3.57298	2.71842	0.00000	0.00259	-0.06827	0.01679	0.06415
0.70	0.25348	12.15712	-0.09791	0.01152	0.69937	2.27700	3.49836	0.05490	1.00016	0.00001	0.00282	0.00220
0.80	0.18102	15.38229	-0.04491	0.00910	0.32078	3.57248	2.71891	0.00000	0.00239	-0.06828	0.01679	0.06417
0.80	0.26517	10.98554	-0.11190	0.01274	0.79926	1.95591	3.83876	0.06099	1.00013	0.00001	0.00227	0.00219
0.90	0.18104	15.37781	-0.04493	0.00910	0.32091	3.57182	2.71962	0.00000	0.00221	-0.06830	0.01678	0.06419
0.90	0.28155	9.23754	-0.12562	0.01516	0.89730	1.46300	4.45548	0.06978	0.99691	-0.00023	0.00184	0.00215

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.100 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
CL= 0.16												
0.20	0.16965	17.67329	-0.04355	0.00905	0.27217	3.76758	2.72055	0.00000	0.39605	-0.04725	0.01673	0.04366
0.20	0.16988	18.45836	-0.03197	0.00867	0.19980	3.90414	2.58709	0.01184	1.00000	0.00000	0.01375	-0.00202
0.30	0.17503	17.28987	-0.05030	0.00925	0.31435	3.64261	2.79452	0.00000	0.25594	-0.05853	0.01634	0.05508
0.30	0.19122	17.67801	-0.04795	0.00905	0.29969	3.53641	2.74600	0.02315	0.99998	-0.00000	0.00990	-0.00020
0.40	0.17719	17.06850	-0.05374	0.00937	0.33585	3.58438	2.83559	0.00000	0.20644	-0.06261	0.01614	0.05922
0.40	0.20705	16.69975	-0.06393	0.00958	0.39959	3.21790	2.93232	0.03130	0.99999	-0.00000	0.00754	0.00083
0.50	0.17865	16.81689	-0.05617	0.00951	0.35104	3.53604	2.87803	-0.00000	0.17688	-0.06513	0.01596	0.06179
0.50	0.22196	15.22288	-0.07992	0.01051	0.49949	2.86477	3.21185	0.03896	0.99999	-0.00000	0.00582	0.00139
0.60	0.17981	16.70593	-0.05774	0.00958	0.36085	3.50638	2.89894	0.00000	0.14901	-0.06743	0.01587	0.06411
0.60	0.23996	14.17191	-0.09590	0.01129	0.59940	2.51152	3.45466	0.04874	0.99999	-0.00000	0.00395	0.00210
0.70	0.18058	16.56113	-0.05931	0.00966	0.37071	3.47865	2.92441	0.00000	0.13594	-0.06858	0.01576	0.06529
0.70	0.25299	12.99854	-0.11189	0.01231	0.69934	2.19282	3.74935	0.05538	1.00008	0.00001	0.00307	0.00226
0.80	0.18126	16.37128	-0.06065	0.00977	0.37905	3.44900	2.95610	-0.00000	0.12518	-0.06957	0.01564	0.06631
0.80	0.26652	11.58843	-0.12790	0.01381	0.79937	1.82607	4.16169	0.06237	1.00036	0.00003	0.00246	0.00218
0.90	0.18191	16.08403	-0.06144	0.00995	0.38402	3.41248	3.00012	-0.00007	0.11236	-0.07078	0.01550	0.06752
0.90	0.28499	9.72189	-0.14470	0.01646	0.90438	1.29426	4.87784	0.07235	1.00905	0.00077	0.00189	0.00120

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.100 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
CL= 0.08												
0.10	0.19107	5.71293	-0.00799	0.01400	0.09990	5.08757	3.82012	0.04106	1.00000	-0.00000	0.00643	-0.00166
0.10	0.20388	5.41139	-0.02535	0.01478	0.31688	4.71027	4.08130	0.04278	0.00001	-0.04172	0.00610	0.04021
0.20	0.20388	5.41139	-0.02535	0.01478	0.31688	4.71027	4.08131	0.04278	0.00000	-0.04172	0.00610	0.04021
0.20	0.20401	5.58941	-0.01598	0.01431	0.19980	4.81686	3.93493	0.05364	1.00000	0.00000	0.00425	-0.00058
0.30	0.20388	5.41139	-0.02535	0.01478	0.31688	4.71026	4.08130	0.04278	0.00001	-0.04172	0.00610	0.04021
0.30	0.21133	5.46859	-0.02398	0.01463	0.29969	4.63299	4.04413	0.06001	0.99996	-0.00000	0.00326	-0.00008
0.40	0.20388	5.41139	-0.02535	0.01478	0.31688	4.71027	4.08131	0.04278	0.00000	-0.04172	0.00610	0.04021
0.40	0.21681	5.33146	-0.03197	0.01501	0.39959	4.47374	4.16531	0.06454	0.99999	-0.00000	0.00264	0.00022
0.50	0.20388	5.41140	-0.02535	0.01478	0.31689	4.71027	4.08130	0.04278	0.00001	-0.04172	0.00610	0.04021
0.50	0.22200	5.13370	-0.03996	0.01558	0.49949	4.29715	4.33676	0.06872	0.99999	-0.00000	0.00219	0.00042
0.60	0.20388	5.41139	-0.02535	0.01478	0.31689	4.71027	4.08130	0.04278	0.00001	-0.04172	0.00610	0.04021
0.60	0.22815	4.98399	-0.04795	0.01605	0.59939	4.12056	4.48086	0.07391	0.99997	-0.00000	0.00159	0.00070
0.70	0.20388	5.41139	-0.02535	0.01478	0.31688	4.71027	4.08131	0.04278	0.00000	-0.04172	0.00610	0.04021
0.70	0.23262	4.81244	-0.05595	0.01662	0.69936	3.96132	4.64868	0.07738	1.00015	0.00001	0.00130	0.00081
0.80	0.20388	5.41140	-0.02535	0.01478	0.31689	4.71027	4.08130	0.04278	0.00001	-0.04172	0.00610	0.04021
0.80	0.23724	4.59038	-0.06391	0.01743	0.79883	3.77777	4.87374	0.08097	0.99925	-0.00003	0.00111	0.00090
0.90	0.20388	5.41140	-0.02535	0.01478	0.31689	4.71027	4.08130	0.04278	0.00001	-0.04172	0.00610	0.04021
0.90	0.24351	4.23692	-0.07195	0.01888	0.89944	3.50075	5.26023	0.08610	1.00058	0.00002	0.00094	0.00083
CL= 0.10												
0.10	0.18048	7.06708	-0.00999	0.01415	0.09990	5.28516	3.87800	0.03246	0.99999	-0.00000	0.00790	-0.00204
0.10	0.19649	6.59683	-0.03167	0.01516	0.31673	4.81401	4.21108	0.03446	0.00000	-0.05234	0.00737	0.05052
0.20	0.19649	6.59683	-0.03167	0.01516	0.31673	4.81400	4.21108	0.03446	0.00000	-0.05234	0.00737	0.05052
0.20	0.19667	6.87271	-0.01998	0.01455	0.19980	4.94678	4.02412	0.04818	1.00000	0.00000	0.00519	-0.00070
0.30	0.19649	6.59683	-0.03167	0.01516	0.31673	4.81400	4.21108	0.03446	-0.00000	-0.05234	0.00737	0.05052
0.30	0.20583	6.68367	-0.02997	0.01496	0.29969	4.71695	4.16385	0.05614	0.99998	-0.00000	0.00395	-0.00010
0.40	0.19649	6.59683	-0.03167	0.01516	0.31673	4.81400	4.21108	0.03446	-0.00000	-0.05234	0.00737	0.05052
0.40	0.21269	6.47110	-0.03996	0.01545	0.39959	4.51788	4.31964	0.06180	0.99997	-0.00000	0.00318	0.00026
0.50	0.19649	6.59682	-0.03167	0.01516	0.31673	4.81400	4.21109	0.03446	-0.00001	-0.05234	0.00737	0.05052
0.50	0.21921	6.16942	-0.04995	0.01621	0.49949	4.29718	4.54108	0.06702	0.99999	-0.00000	0.00261	0.00049
0.60	0.19649	6.59683	-0.03167	0.01516	0.31673	4.81400	4.21108	0.03446	-0.00000	-0.05234	0.00737	0.05052
0.60	0.22692	5.94258	-0.05994	0.01683	0.59940	4.07640	4.72843	0.07353	0.99998	-0.00000	0.00189	0.00081
0.70	0.19649	6.59683	-0.03167	0.01516	0.31673	4.81400	4.21108	0.03446	-0.00000	-0.05234	0.00737	0.05052
0.70	0.23256	5.68647	-0.06993	0.01759	0.69932	3.87728	4.94750	0.07788	1.00003	0.00000	0.00155	0.00093
0.80	0.19649	6.59683	-0.03167	0.01516	0.31673	4.81400	4.21108	0.03446	-0.00000	-0.05234	0.00737	0.05052
0.80	0.23840	5.36229	-0.07991	0.01865	0.79913	3.64750	5.24377	0.08239	0.99987	-0.00001	0.00130	0.00098
0.90	0.19649	6.59682	-0.03167	0.01516	0.31673	4.81400	4.21109	0.03446	-0.00001	-0.05234	0.00737	0.05052
0.90	0.24591	4.90097	-0.09003	0.02040	0.90025	3.32356	5.74256	0.08844	1.00197	0.00011	0.00109	0.00084

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.100 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.12

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.16989	8.39078	-0.01199	0.01430	0.09990	5.48276	3.93673	0.02381	1.00001	0.00000	0.00932	-0.00240
0.10	0.18912	7.71640	-0.03799	0.01555	0.31658	4.91789	4.34435	0.02604	0.00002	-0.06303	0.00855	0.06092
0.20	0.18912	7.71637	-0.03799	0.01555	0.31658	4.91789	4.34436	0.02604	0.00000	-0.06303	0.00855	0.06092
0.20	0.18933	8.10947	-0.02398	0.01480	0.19980	5.07670	4.11520	0.04268	1.00000	0.00000	0.00607	-0.00082
0.30	0.18912	7.71638	-0.03799	0.01555	0.31658	4.91789	4.34436	0.02604	-0.00001	-0.06303	0.00855	0.06092
0.30	0.20034	7.83767	-0.03596	0.01531	0.29969	4.80090	4.28677	0.05224	0.99998	-0.00000	0.00459	-0.00012
0.40	0.18912	7.71638	-0.03799	0.01555	0.31658	4.91789	4.34437	0.02604	-0.00002	-0.06303	0.00855	0.06092
0.40	0.20859	7.53513	-0.04795	0.01593	0.39959	4.56202	4.47888	0.05903	0.99999	-0.00000	0.00368	0.00029
0.50	0.18912	7.71640	-0.03799	0.01555	0.31658	4.91789	4.34436	0.02604	-0.00001	-0.06303	0.00855	0.06092
0.50	0.21645	7.11270	-0.05994	0.01687	0.49949	4.29718	4.75314	0.06529	1.00000	-0.00000	0.00300	0.00055
0.60	0.18912	7.71639	-0.03799	0.01555	0.31658	4.91789	4.34436	0.02604	-0.00000	-0.06303	0.00855	0.06092
0.60	0.22574	6.79768	-0.07193	0.01765	0.59940	4.03224	4.98658	0.07312	1.00000	-0.00000	0.00216	0.00090
0.70	0.18912	7.71639	-0.03799	0.01555	0.31658	4.91790	4.34436	0.02604	0.00000	-0.06303	0.00855	0.06092
0.70	0.23253	6.44747	-0.08392	0.01861	0.69930	3.79332	5.26055	0.07834	0.99998	-0.00000	0.00177	0.00102
0.80	0.18912	7.71640	-0.03799	0.01555	0.31658	4.91789	4.34436	0.02604	-0.00001	-0.06303	0.00855	0.06092
0.80	0.23959	6.01218	-0.09587	0.01996	0.79892	3.51775	5.63228	0.08374	0.99944	-0.00004	0.00148	0.00109
0.90	0.18912	7.71640	-0.03799	0.01555	0.31658	4.91789	4.34436	0.02604	-0.00001	-0.06303	0.00855	0.06092
0.90	0.24930	5.36977	-0.10745	0.02235	0.89540	3.10971	6.27174	0.09103	0.99366	-0.00041	0.00126	0.00140

CL= 0.14

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.15931	9.68378	-0.01399	0.01446	0.09990	5.68035	3.99634	0.01512	0.99998	-0.00000	0.01069	-0.00275
0.10	0.18175	8.77145	-0.04430	0.01596	0.31644	5.02195	4.48113	0.01753	0.00002	-0.07378	0.00965	0.07139
0.20	0.18175	8.77142	-0.04430	0.01596	0.31644	5.02193	4.48114	0.01753	0.00000	-0.07378	0.00965	0.07139
0.20	0.18200	9.29963	-0.02797	0.01505	0.19980	5.20662	4.20820	0.03713	1.00000	0.00000	0.00691	-0.00093
0.30	0.18175	8.77142	-0.04430	0.01596	0.31644	5.02194	4.48115	0.01753	0.00000	-0.07378	0.00965	0.07139
0.30	0.19486	8.93126	-0.04196	0.01568	0.29969	4.83485	4.41289	0.04829	0.99999	-0.00000	0.00520	-0.00013
0.40	0.18175	8.77143	-0.04430	0.01596	0.31644	5.02193	4.48114	0.01753	-0.00000	-0.07378	0.00965	0.07139
0.40	0.20452	8.52561	-0.05594	0.01642	0.39959	4.60615	4.64304	0.05621	0.99999	-0.00000	0.00414	0.00032
0.50	0.18175	8.77143	-0.04430	0.01596	0.31644	5.02193	4.48114	0.01753	-0.00000	-0.07378	0.00965	0.07139
0.50	0.21372	7.96841	-0.06993	0.01757	0.49948	4.29718	4.97291	0.06351	0.99999	-0.00000	0.00335	0.00060
0.60	0.18175	8.77143	-0.04430	0.01596	0.31644	5.02194	4.48114	0.01753	-0.00000	-0.07378	0.00965	0.07139
0.60	0.22459	7.55671	-0.08392	0.01853	0.59940	3.98808	5.25524	0.07267	0.99998	-0.00000	0.00241	0.00097
0.70	0.18175	8.77143	-0.04430	0.01596	0.31644	5.02194	4.48114	0.01753	-0.00000	-0.07378	0.00965	0.07139
0.70	0.23255	7.10660	-0.09790	0.01970	0.69932	3.70950	5.58762	0.07877	1.00003	0.00000	0.00196	0.00109
0.80	0.18175	8.77144	-0.04430	0.01596	0.31644	5.02194	4.48113	0.01753	0.00000	-0.07378	0.00965	0.07139
0.80	0.24086	6.55855	-0.11189	0.02135	0.79923	3.36838	6.03859	0.08511	1.00007	0.00001	0.00163	0.00111
0.90	0.18175	8.77144	-0.04430	0.01596	0.31644	5.02194	4.48113	0.01753	0.00000	-0.07378	0.00965	0.07139
0.90	0.25197	5.73978	-0.12475	0.02439	0.89104	2.90815	6.81488	0.09333	0.98621	-0.00105	0.00141	0.00206

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.100 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.14872	10.94594	-0.01598	0.01462	0.09990	5.87796	4.05681	0.00638	1.00000	0.00000	0.01202	-0.00309
0.10	0.17439	9.76361	-0.05061	0.01639	0.31630	5.12611	4.62141	0.00894	0.00001	-0.08459	0.01067	0.08195
0.20	0.17439	9.76361	-0.05061	0.01639	0.31630	5.12611	4.62141	0.00894	0.00000	-0.08459	0.01067	0.08195
0.20	0.17468	10.44339	-0.03197	0.01532	0.19980	5.33654	4.30311	0.03155	1.00000	0.00000	0.00771	-0.00104
0.30	0.17439	9.76362	-0.05061	0.01639	0.31630	5.12610	4.62141	0.00894	0.00001	-0.08458	0.01067	0.08195
0.30	0.18940	9.96545	-0.04795	0.01606	0.29969	4.96881	4.54220	0.04431	0.99999	-0.00000	0.00576	-0.00015
0.40	0.17439	9.76360	-0.05061	0.01639	0.31630	5.12611	4.62141	0.00894	0.00000	-0.08459	0.01067	0.08195
0.40	0.20045	9.44505	-0.06393	0.01694	0.39959	4.65030	4.81208	0.05336	0.99999	-0.00000	0.00456	0.00035
0.50	0.17439	9.76360	-0.05061	0.01639	0.31630	5.12611	4.62141	0.00894	0.00000	-0.08459	0.01067	0.08195
0.50	0.21102	8.74187	-0.07992	0.01830	0.49949	4.29718	5.20036	0.06170	0.99999	-0.00000	0.00367	0.00063
0.60	0.17439	9.76360	-0.05061	0.01639	0.31630	5.12611	4.62141	0.00894	0.00000	-0.08459	0.01067	0.08195
0.60	0.22147	8.22737	-0.09590	0.01945	0.59940	3.94394	5.53442	0.07220	0.99999	-0.00000	0.00263	0.00103
0.70	0.17439	9.76361	-0.05061	0.01639	0.31630	5.12611	4.62141	0.00894	0.00000	-0.08459	0.01067	0.08195
0.70	0.23262	7.67321	-0.11189	0.02085	0.69929	3.62552	5.92900	0.07918	0.99995	-0.00000	0.00213	0.00115
0.80	0.17439	9.76361	-0.05061	0.01639	0.31630	5.12611	4.62141	0.00894	0.00000	-0.08459	0.01067	0.08195
0.80	0.24220	7.00732	-0.12785	0.02283	0.79908	3.25725	6.46867	0.08642	0.99976	-0.00002	0.00176	0.00118
0.90	0.17439	9.76360	-0.05061	0.01639	0.31630	5.12611	4.62141	0.00894	0.00000	-0.08459	0.01067	0.08195
0.90	0.25537	6.10102	-0.14461	0.02623	0.90383	2.72075	7.37080	0.09681	1.00809	0.00071	0.00139	0.00038

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.100 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.19130	3.64314	-0.00799	0.02196	0.09990	6.51997	5.93056	0.06383	1.00000	0.00000	0.00395	-0.00096
0.10	0.20102	3.45999	-0.02522	0.02312	0.31521	6.14667	6.28184	0.06538	0.00000	-0.04341	0.00385	0.04245
0.20	0.20102	3.45998	-0.02522	0.02312	0.31521	6.14667	6.28185	0.06538	0.00000	-0.04341	0.00385	0.04245
0.20	0.20113	3.56250	-0.01598	0.02246	0.19980	6.24926	6.08882	0.07716	1.00000	0.00000	0.00266	-0.00035
0.30	0.20102	3.45998	-0.02522	0.02312	0.31521	6.14666	6.28185	0.06538	0.00002	-0.04340	0.00385	0.04245
0.30	0.20673	3.48752	-0.02398	0.02294	0.29969	6.06540	6.23721	0.08387	0.99997	-0.00000	0.00207	-0.00006
0.40	0.20102	3.45998	-0.02522	0.02312	0.31521	6.14666	6.28185	0.06538	0.00001	-0.04340	0.00385	0.04245
0.40	0.21095	3.40623	-0.03197	0.02349	0.39959	5.90614	6.39954	0.08861	0.99998	-0.00000	0.00171	0.00011
0.50	0.20102	3.45998	-0.02522	0.02312	0.31521	6.14666	6.28185	0.06538	0.00001	-0.04340	0.00385	0.04245
0.50	0.21499	3.29473	-0.03996	0.02428	0.49949	5.72958	6.62520	0.09296	0.99999	-0.00000	0.00145	0.00022
0.60	0.20102	3.45998	-0.02522	0.02312	0.31521	6.14666	6.28185	0.06538	0.00001	-0.04340	0.00385	0.04245
0.60	0.21971	3.20845	-0.04795	0.02493	0.59940	5.55294	6.81488	0.09835	1.00000	-0.00000	0.00108	0.00039
0.70	0.20102	3.45998	-0.02522	0.02312	0.31521	6.14666	6.28185	0.06538	0.00001	-0.04340	0.00385	0.04245
0.70	0.22319	3.11215	-0.05594	0.02571	0.69931	5.39375	7.03288	0.10192	1.00000	-0.00000	0.00092	0.00046
0.80	0.20102	3.45999	-0.02522	0.02312	0.31521	6.14666	6.28184	0.06538	0.00001	-0.04340	0.00385	0.04245
0.80	0.22681	2.98907	-0.06387	0.02676	0.79842	5.20956	7.32288	0.10557	0.99840	-0.00007	0.00080	0.00056
0.90	0.20102	3.45998	-0.02522	0.02312	0.31521	6.14666	6.28185	0.06538	0.00001	-0.04340	0.00385	0.04245
0.90	0.23165	2.81646	-0.07302	0.02840	0.91276	4.94794	7.79831	0.11113	1.02337	0.00103	0.00063	-0.00050

CL= 0.10

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.18342	4.50374	-0.00999	0.02220	0.09990	6.71756	6.01097	0.05472	0.99999	-0.00000	0.00487	-0.00121
0.10	0.19558	4.22186	-0.03151	0.02369	0.31513	6.25118	6.45652	0.05658	0.00000	-0.05436	0.00468	0.05320
0.20	0.19558	4.22185	-0.03151	0.02369	0.31513	6.25113	6.45654	0.05658	0.00000	-0.05436	0.00468	0.05320
0.20	0.19571	4.37886	-0.01998	0.02284	0.19980	6.37917	6.21135	0.07138	1.00000	0.00000	0.00326	-0.00042
0.30	0.19558	4.22185	-0.03151	0.02369	0.31513	6.25117	6.45654	0.05658	0.00000	-0.05436	0.00468	0.05320
0.30	0.20272	4.26350	-0.02997	0.02345	0.29969	6.14935	6.39998	0.07977	0.99998	-0.00000	0.00252	-0.00007
0.40	0.19558	4.22185	-0.03151	0.02369	0.31513	6.25117	6.45654	0.05658	0.00000	-0.05436	0.00468	0.05320
0.40	0.20800	4.13941	-0.03996	0.02416	0.39959	5.95023	6.60709	0.08570	0.99997	-0.00000	0.00207	0.00013
0.50	0.19558	4.22185	-0.03151	0.02369	0.31513	6.25117	6.45654	0.05658	0.00000	-0.05436	0.00468	0.05320
0.50	0.21306	3.97115	-0.04995	0.02513	0.49949	5.72958	6.89610	0.09112	0.99999	-0.00000	0.00174	0.00026
0.60	0.19558	4.22185	-0.03151	0.02369	0.31513	6.25117	6.45654	0.05658	0.00000	-0.05436	0.00468	0.05320
0.60	0.21898	3.84199	-0.05994	0.02603	0.59940	5.50879	7.14023	0.09788	1.00000	0.00000	0.00130	0.00046
0.70	0.19558	4.22185	-0.03151	0.02369	0.31513	6.25116	6.45653	0.05658	-0.00000	-0.05436	0.00468	0.05320
0.70	0.22334	3.69930	-0.06993	0.02703	0.69931	5.30965	7.42194	0.10234	1.00002	0.00000	0.00109	0.00053
0.80	0.19558	4.22185	-0.03151	0.02369	0.31513	6.25117	6.45654	0.05658	0.00000	-0.05436	0.00468	0.05320
0.80	0.22789	3.52174	-0.07992	0.02840	0.79916	5.08055	7.79640	0.10694	0.99992	-0.00000	0.00094	0.00057
0.90	0.19558	4.22185	-0.03151	0.02369	0.31513	6.25117	6.45653	0.05658	-0.00000	-0.05436	0.00468	0.05320
0.90	0.23394	3.24348	-0.08896	0.03083	0.88964	4.73946	8.41610	0.11274	0.98382	-0.00089	0.00085	0.00143

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.100 T= 0.200

ELLIPTICAL PRESSURE DISTR[illegible]UTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA		YC(1)	M	ACAP	BINT	DINT
CL= 0.12												
0.10	0.17555	5.34463	-0.01199	0.02245	0.09990	6.91516	6.09223	0.04558	1.00000	0.00000	0.00576	-0.00143
0.10	0.19013	4.94508	-0.03781	0.02427	0.31505	6.35577	6.63463	0.04772	0.00001	-0.06535	0.00546	0.06400
0.20	0.19013	4.94507	-0.03781	0.02427	0.31505	6.35577	6.63464	0.04772	0.00000	-0.06535	0.00546	0.06400
0.20	0.19030	5.16652	-0.02398	0.02323	0.19980	6.50909	6.33573	0.06558	1.00000	0.00000	0.00383	-0.00050
0.30	0.19013	4.94507	-0.03781	0.02427	0.31505	6.35576	6.63464	0.04772	-0.00001	-0.06535	0.00546	0.06400
0.30	0.19871	5.00308	-0.03596	0.02399	0.29969	6.23330	6.56587	0.07565	0.99996	-0.00000	0.00295	-0.00009
0.40	0.19013	4.94507	-0.03781	0.02427	0.31505	6.35576	6.63463	0.04772	0.00000	-0.06535	0.00546	0.06400
0.40	0.20505	4.82872	-0.04795	0.02485	0.39959	5.99442	6.81941	0.08276	0.99998	-0.00000	0.00241	0.00015
0.50	0.19013	4.94508	-0.03781	0.02427	0.31505	6.35576	6.63464	0.04772	-0.00000	-0.06535	0.00546	0.06400
0.50	0.21114	4.59502	-0.05994	0.02612	0.49949	5.72958	7.17454	0.08927	1.00000	0.00000	0.00201	0.00030
0.60	0.19013	4.94507	-0.03781	0.02427	0.31505	6.35577	6.63463	0.04772	0.00000	-0.06535	0.00546	0.06400
0.60	0.21826	4.41709	-0.07193	0.02717	0.59940	5.46464	7.47586	0.09738	1.00001	0.00000	0.00149	0.00052
0.70	0.19013	4.94507	-0.03781	0.02427	0.31505	6.35576	6.63463	0.04772	0.00000	-0.06535	0.00546	0.06400
0.70	0.22351	4.22282	-0.08391	0.02842	0.69927	5.22580	7.82473	0.10274	0.99992	-0.00001	0.00125	0.00060
0.80	0.19013	4.94508	-0.03781	0.02427	0.31505	6.35576	6.63464	0.04772	-0.00000	-0.06535	0.00546	0.06400
0.80	0.22900	3.98377	-0.09590	0.03012	0.79919	4.95045	8.29017	0.10826	0.99999	-0.00000	0.00107	0.00063
0.90	0.19013	4.94507	-0.03781	0.02427	0.31505	6.35577	6.63463	0.04772	0.00000	-0.06535	0.00546	0.06400
0.90	0.23636	3.62779	-0.10693	0.03308	0.89109	4.54716	9.06981	0.11520	0.98630	-0.00091	0.00095	0.00150
CL= 0.14												
0.10	0.16767	6.16601	-0.01399	0.02271	0.09990	7.11276	6.17434	0.03642	1.00000	0.00000	0.00662	-0.00164
0.10	0.18469	5.63104	-0.04410	0.02486	0.31498	6.46044	6.81614	0.03881	0.00001	-0.07637	0.00619	0.07484
0.20	0.18469	5.63102	-0.04410	0.02486	0.31498	6.46044	6.81615	0.03881	0.00000	-0.07637	0.00619	0.07484
0.20	0.18489	5.92605	-0.02797	0.02362	0.19980	6.63902	6.46197	0.05975	1.00000	0.00000	0.00437	-0.00057
0.30	0.18469	5.63103	-0.04410	0.02486	0.31498	6.46043	6.81615	0.03881	-0.00001	-0.07638	0.00619	0.07484
0.30	0.19471	5.70736	-0.04196	0.02453	0.29969	6.31725	6.73487	0.07151	0.99999	-0.00000	0.00335	-0.00010
0.40	0.18469	5.63103	-0.04410	0.02486	0.31498	6.46044	6.81614	0.03881	0.00001	-0.07637	0.00619	0.07484
0.40	0.20212	5.47603	-0.05594	0.02557	0.39959	6.03856	7.03651	0.07980	0.99999	-0.00000	0.00272	0.00017
0.50	0.18469	5.63103	-0.04410	0.02486	0.31498	6.46044	6.81614	0.03881	0.00001	-0.07637	0.00619	0.07484
0.50	0.20924	5.16955	-0.06993	0.02708	0.49949	5.72957	7.46047	0.08739	0.99999	-0.00000	0.00225	0.00035
0.60	0.18469	5.63103	-0.04410	0.02486	0.31498	6.46044	6.81614	0.03881	0.00000	-0.07637	0.00619	0.07484
0.60	0.21755	4.93817	-0.08392	0.02835	0.59940	5.42048	7.82175	0.09687	1.00000	0.00000	0.00167	0.00057
0.70	0.18469	5.63102	-0.04410	0.02486	0.31498	6.46043	6.81615	0.03881	-0.00001	-0.07637	0.00619	0.07484
0.70	0.22370	4.68838	-0.09791	0.02986	0.69932	5.14174	8.24148	0.10313	1.00005	0.00000	0.00139	0.00064
0.80	0.18469	5.63102	-0.04410	0.02486	0.31498	6.46044	6.81615	0.03881	0.00000	-0.07637	0.00619	0.07484
0.80	0.23013	4.38580	-0.11190	0.03192	0.79927	4.82093	8.80399	0.10957	1.00016	0.00001	0.00118	0.00066
0.90	0.18469	5.63103	-0.04410	0.02486	0.31498	6.46043	6.81614	0.03881	0.00000	-0.07637	0.00619	0.07484
0.90	0.23853	3.95791	-0.12579	0.03537	0.89850	4.36056	9.74965	0.11825	0.99897	-0.00008	0.00099	0.00073

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.100 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.15980	6.96812	-0.01598	0.02296	0.09990	7.31035	6.25728	0.02724	0.99999	-0.00000	0.00746	-0.00185
0.10	0.17926	6.28113	-0.05038	0.02547	0.31491	6.56519	7.00105	0.02986	0.00000	-0.08743	0.00688	0.08573
0.20	0.17926	6.28112	-0.05039	0.02547	0.31491	6.56519	7.00106	0.02986	0.00000	-0.08743	0.00688	0.08573
0.20	0.17948	6.65801	-0.03197	0.02403	0.19980	6.75894	6.59007	0.05391	1.00000	0.00000	0.00489	-0.00064
0.30	0.17926	6.28112	-0.05039	0.02547	0.31491	6.56518	7.00106	0.02986	0.00000	-0.08743	0.00688	0.08573
0.30	0.19071	6.37749	-0.04795	0.02509	0.29969	6.40121	6.90696	0.06734	0.99998	-0.00000	0.00373	-0.00011
0.40	0.17926	6.28111	-0.05039	0.02547	0.31491	6.56519	7.00106	0.02986	0.00000	-0.08743	0.00688	0.08573
0.40	0.19919	6.08325	-0.06393	0.02630	0.39959	6.08270	7.25835	0.07682	1.00000	-0.00000	0.00302	0.00018
0.50	0.17926	6.28112	-0.05039	0.02547	0.31491	6.56517	7.00106	0.02986	0.00000	-0.08743	0.00688	0.08573
0.50	0.20735	5.69791	-0.07992	0.02808	0.49949	5.72957	7.75388	0.08549	0.99999	-0.00000	0.00248	0.00036
0.60	0.17926	6.28114	-0.05039	0.02547	0.31491	6.56517	7.00105	0.02986	0.00001	-0.08743	0.00688	0.08573
0.60	0.21686	5.40948	-0.09590	0.02958	0.59940	5.37633	8.17791	0.09634	1.00001	0.00000	0.00183	0.00061
0.70	0.17926	6.28111	-0.05039	0.02547	0.31491	6.56519	7.00106	0.02986	0.00000	-0.08743	0.00688	0.08573
0.70	0.22391	5.10147	-0.11189	0.03136	0.69930	5.05777	8.67184	0.10349	0.99998	-0.00000	0.00151	0.00070
0.80	0.17926	6.28111	-0.05039	0.02547	0.31491	6.56519	7.00106	0.02986	0.00000	-0.08743	0.00688	0.08573
0.80	0.23128	4.73369	-0.12791	0.03380	0.79943	4.69128	9.33507	0.11087	1.00048	0.00004	0.00128	0.00067
0.90	0.17926	6.28113	-0.05039	0.02547	0.31491	6.56518	7.00105	0.02986	0.00001	-0.08742	0.00688	0.08573
0.90	0.24164	4.21954	-0.14521	0.03792	0.90757	4.14891	10.45833	0.12184	1.01447	0.00129	0.00101	-0.00058

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.150 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.24406	6.41007	-0.00799	0.01248	0.09991	3.62079	1.59732	0.02730	0.99995	-0.00000	0.01969	-0.00615
0.10	0.26157	6.42479	-0.02613	0.01245	0.32658	3.23841	1.66523	0.02963	0.00006	-0.03180	0.01717	0.02755
0.20	0.26157	6.42478	-0.02613	0.01245	0.32659	3.23838	1.66524	0.02963	0.00000	-0.03181	0.01717	0.02755
0.20	0.26165	6.45316	-0.01598	0.01240	0.19980	3.36187	1.62366	0.03596	1.00000	0.00000	0.01234	-0.00226
0.30	0.26158	6.42478	-0.02613	0.01245	0.32659	3.23838	1.66524	0.02964	0.00010	-0.03180	0.01717	0.02755
0.30	0.27125	6.47253	-0.02398	0.01236	0.29970	3.18600	1.64994	0.04046	0.99988	-0.00000	0.00881	-0.00025
0.40	0.26158	6.42479	-0.02613	0.01245	0.32659	3.23837	1.66524	0.02963	0.00005	-0.03180	0.01717	0.02755
0.40	0.27812	6.46306	-0.03197	0.01238	0.39959	3.03368	1.68081	0.04379	0.99993	-0.00000	0.00653	0.00116
0.50	0.26158	6.42478	-0.02613	0.01245	0.32660	3.23837	1.66524	0.02963	0.00004	-0.03180	0.01717	0.02755
0.50	0.28420	6.37659	-0.03996	0.01255	0.49948	2.86480	1.72833	0.04704	0.99995	-0.00000	0.00484	0.00229
0.60	0.26158	6.42478	-0.02613	0.01245	0.32660	3.23837	1.66524	0.02963	0.00003	-0.03180	0.01717	0.02755
0.60	0.29195	6.32225	-0.04795	0.01265	0.59939	2.69585	1.76734	0.05100	0.99996	-0.00000	0.00271	0.00353
0.70	0.26158	6.42479	-0.02613	0.01245	0.32660	3.23836	1.66524	0.02963	0.00003	-0.03180	0.01717	0.02755
0.70	0.29716	6.22061	-0.05594	0.01286	0.69931	2.54350	1.81525	0.05383	1.00000	-0.00000	0.00166	0.00422
0.80	0.26158	6.42479	-0.02613	0.01245	0.32660	3.23836	1.66524	0.02963	0.00002	-0.03180	0.01717	0.02755
0.80	0.30224	6.03577	-0.06392	0.01325	0.79905	2.36836	1.88285	0.05694	0.99969	-0.00001	0.00097	0.00466
0.90	0.26158	6.42480	-0.02613	0.01245	0.32661	3.23837	1.66524	0.02963	0.00003	-0.03180	0.01717	0.02755
0.90	0.30826	5.66927	-0.07186	0.01411	0.89821	2.11808	2.00147	0.06140	0.99846	-0.00005	0.00056	0.00480

CL= 0.10

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.22836	8.04746	-0.00999	0.01243	0.09991	3.80979	1.61019	0.02143	0.99996	-0.00000	0.02428	-0.00755
0.10	0.25026	8.03981	-0.03262	0.01244	0.32616	3.33296	1.69780	0.02408	0.00005	-0.04015	0.02087	0.03499
0.20	0.25026	8.03979	-0.03262	0.01244	0.32617	3.33293	1.69781	0.02408	0.00000	-0.04015	0.02087	0.03499
0.20	0.25038	8.10528	-0.01998	0.01234	0.19980	3.48614	1.64406	0.03225	1.00000	0.00000	0.01512	-0.00275
0.30	0.25026	8.03980	-0.03262	0.01244	0.32617	3.33292	1.69781	0.02408	0.00007	-0.04015	0.02087	0.03499
0.30	0.26240	8.12222	-0.02997	0.01231	0.29970	3.26630	1.67817	0.03789	0.99991	-0.00000	0.01075	-0.00030
0.40	0.25026	8.03981	-0.03262	0.01244	0.32617	3.33292	1.69781	0.02408	0.00004	-0.04015	0.02087	0.03499
0.40	0.27103	8.08816	-0.03996	0.01236	0.39959	3.07590	1.71857	0.04205	0.99995	-0.00000	0.00796	0.00139
0.50	0.25026	8.03980	-0.03262	0.01244	0.32617	3.33292	1.69781	0.02408	0.00002	-0.04015	0.02087	0.03499
0.50	0.27872	7.92254	-0.04995	0.01262	0.49948	2.86480	1.78115	0.04613	0.99995	-0.00000	0.00591	0.00267
0.60	0.25026	8.03978	-0.03262	0.01244	0.32617	3.33291	1.69781	0.02408	0.00002	-0.04015	0.02087	0.03499
0.60	0.28848	7.80953	-0.05994	0.01280	0.59939	2.65362	1.83310	0.05112	0.99995	-0.00000	0.00338	0.00407
0.70	0.25026	8.03980	-0.03262	0.01244	0.32617	3.33291	1.69781	0.02408	0.00002	-0.04015	0.02087	0.03499
0.70	0.29512	7.61869	-0.06993	0.01313	0.69929	2.46316	1.89725	0.05469	0.99997	-0.00000	0.00219	0.00477
0.80	0.25026	8.03981	-0.03262	0.01244	0.32618	3.33292	1.69781	0.02408	0.00002	-0.04015	0.02087	0.03499
0.80	0.30169	7.29561	-0.07994	0.01371	0.79941	2.24314	1.98881	0.05863	1.00044	0.00002	0.00141	0.00513
0.90	0.25026	8.03981	-0.03262	0.01244	0.32618	3.33291	1.69781	0.02408	0.00002	-0.04015	0.02087	0.03499
0.90	0.31003	6.68637	-0.08984	0.01496	0.89837	1.92426	2.15037	0.06423	0.99873	-0.00006	0.00101	0.00509

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.150 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
CL= 0.12												
0.10	0.21267	9.69536	-0.01199	0.01238	0.09991	3.99880	1.62336	0.01548	0.99996	-0.00000	0.02873	-0.00891
0.10	0.23896	9.64033	-0.03909	0.01245	0.32575	3.42793	1.73182	0.01833	0.00003	-0.04865	0.02434	0.04263
0.20	0.23896	9.64029	-0.03909	0.01245	0.32575	3.42790	1.73183	0.01833	0.00000	-0.04865	0.02434	0.04264
0.20	0.23912	9.76457	-0.02398	0.01229	0.19980	3.61041	1.66517	0.02848	1.00000	0.00000	0.01778	-0.00320
0.30	0.23896	9.64031	-0.03909	0.01245	0.32575	3.42790	1.73182	0.01834	0.00007	-0.04865	0.02434	0.04262
0.30	0.25359	9.76946	-0.03596	0.01228	0.29970	3.34661	1.70765	0.03525	0.99993	-0.00000	0.01260	-0.00033
0.40	0.23896	9.64031	-0.03909	0.01245	0.32576	3.42789	1.73183	0.01834	0.00003	-0.04865	0.02434	0.04263
0.40	0.25400	9.69296	-0.04795	0.01238	0.39959	3.11812	1.75834	0.04025	0.99996	-0.00000	0.00931	0.00159
0.50	0.23896	9.64029	-0.03909	0.01245	0.32576	3.42789	1.73183	0.01834	0.00003	-0.04865	0.02434	0.04263
0.50	0.27332	9.41375	-0.05994	0.01275	0.49948	2.86479	1.83732	0.04513	0.99997	-0.00000	0.00691	0.00298
0.60	0.23896	9.64029	-0.03909	0.01245	0.32576	3.42789	1.73183	0.01834	0.00002	-0.04865	0.02434	0.04264
0.60	0.28513	9.21503	-0.07193	0.01302	0.59940	2.61138	1.90364	0.05119	1.00000	-0.00000	0.00404	0.00450
0.70	0.23896	9.64031	-0.03909	0.01245	0.32576	3.42789	1.73183	0.01834	0.00002	-0.04865	0.02434	0.04264
0.70	0.29322	8.90275	-0.08392	0.01348	0.69932	2.38268	1.98594	0.05552	1.00003	0.00000	0.00271	0.00518
0.80	0.23896	9.64030	-0.03909	0.01245	0.32576	3.42788	1.73183	0.01834	0.00001	-0.04865	0.02434	0.04264
0.80	0.30124	8.40609	-0.09589	0.01428	0.79910	2.11975	2.10323	0.06023	0.99981	-0.00001	0.00188	0.00547
0.90	0.23896	9.64030	-0.03909	0.01245	0.32576	3.42789	1.73183	0.01834	0.00002	-0.04865	0.02434	0.04264
0.90	0.31225	7.51242	-0.10777	0.01597	0.89811	1.72885	2.31445	0.06703	0.99829	-0.00009	0.00146	0.00523
CL= 0.14												
0.10	0.19699	11.35193	-0.01399	0.01233	0.09991	4.18780	1.63684	0.00945	0.99997	-0.00000	0.03304	-0.01022
0.10	0.22766	11.21768	-0.04555	0.01248	0.32534	3.52332	1.76731	0.01241	0.00004	-0.05729	0.02760	0.05048
0.20	0.22767	11.21767	-0.04555	0.01248	0.32535	3.52331	1.76732	0.01241	0.00000	-0.05730	0.02760	0.05048
0.20	0.22788	11.42656	-0.02797	0.01225	0.19980	3.73468	1.68699	0.02462	1.00000	0.00000	0.02033	-0.00363
0.30	0.22767	11.21768	-0.04555	0.01248	0.32535	3.52329	1.76731	0.01241	0.00006	-0.05729	0.02760	0.05048
0.30	0.24480	11.40645	-0.04196	0.01227	0.29970	3.42691	1.73841	0.03253	0.99992	-0.00000	0.01435	-0.00037
0.40	0.22767	11.21766	-0.04555	0.01248	0.32535	3.52329	1.76732	0.01241	0.00002	-0.05729	0.02760	0.05048
0.40	0.25700	11.26588	-0.05594	0.01243	0.39959	3.16034	1.80019	0.03837	0.99996	-0.00000	0.01058	0.00177
0.50	0.22767	11.21766	-0.04555	0.01248	0.32535	3.52329	1.76732	0.01241	0.00002	-0.05729	0.02760	0.05048
0.50	0.26800	10.83565	-0.06993	0.01292	0.49948	2.86479	1.89693	0.04407	0.99997	-0.00000	0.00785	0.00324
0.60	0.22767	11.21765	-0.04555	0.01248	0.32535	3.52329	1.76732	0.01241	0.00001	-0.05729	0.02760	0.05048
0.60	0.28188	10.52273	-0.08392	0.01330	0.59939	2.56914	1.97897	0.05121	0.99998	-0.00000	0.00468	0.00484
0.70	0.22767	11.21765	-0.04555	0.01248	0.32536	3.52328	1.76732	0.01241	0.00002	-0.05729	0.02760	0.05048
0.70	0.29146	10.05957	-0.09790	0.01392	0.69931	2.30239	2.08109	0.05628	1.00000	0.00000	0.00323	0.00548
0.80	0.22767	11.21765	-0.04555	0.01248	0.32536	3.52328	1.76732	0.01241	0.00001	-0.05729	0.02760	0.05048
0.80	0.30109	9.36079	-0.11191	0.01496	0.79932	1.99517	2.22714	0.06183	1.00029	0.00002	0.00233	0.00563
0.90	0.22767	11.21766	-0.04555	0.01248	0.32536	3.52328	1.76732	0.01241	0.00001	-0.05730	0.02760	0.05048
0.90	0.31352	8.10576	-0.12439	0.01727	0.88851	1.53949	2.49258	0.06931	0.98170	-0.00117	0.00213	0.00616

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.150 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.18132	13.01524	-0.01598	0.01229	0.09990	4.37681	1.65063	0.00334	0.99998	-0.00000	0.03723	-0.01147
0.10	0.21638	12.76375	-0.05199	0.01254	0.32495	3.61913	1.80430	0.00631	0.00004	-0.06608	0.03065	0.05853
0.20	0.21638	12.76375	-0.05199	0.01254	0.32495	3.61910	1.80430	0.00631	0.00000	-0.06609	0.03065	0.05853
0.20	0.21666	13.08673	-0.03197	0.01223	0.19980	3.85895	1.70956	0.02069	1.00000	0.00000	0.02277	-0.00403
0.30	0.21638	12.76373	-0.05199	0.01254	0.32495	3.61910	1.80430	0.00631	0.00003	-0.06609	0.03065	0.05853
0.30	0.23604	13.02555	-0.04795	0.01228	0.29970	3.50721	1.77048	0.02974	0.99993	-0.00000	0.01600	-0.00039
0.40	0.21638	12.76374	-0.05199	0.01254	0.32496	3.61909	1.80430	0.00631	0.00003	-0.06609	0.03065	0.05853
0.40	0.25006	12.79606	-0.06393	0.01250	0.39959	3.20255	1.84414	0.03642	0.99997	-0.00000	0.01177	0.00193
0.50	0.21638	12.76372	-0.05199	0.01254	0.32496	3.61909	1.80431	0.00631	0.00002	-0.06609	0.03065	0.05853
0.50	0.26275	12.17629	-0.07992	0.01314	0.49948	2.86479	1.96002	0.04293	0.99997	-0.00000	0.00873	0.00345
0.60	0.21638	12.76371	-0.05199	0.01254	0.32496	3.61908	1.80431	0.00631	0.00001	-0.06609	0.03065	0.05853
0.60	0.27874	11.72162	-0.09590	0.01365	0.59939	2.52689	2.05917	0.05117	0.99998	-0.00000	0.00528	0.00509
0.70	0.21638	12.76370	-0.05199	0.01254	0.32496	3.61909	1.80431	0.00631	0.00001	-0.06609	0.03065	0.05853
0.70	0.28984	11.08284	-0.11189	0.01444	0.69930	2.22221	2.18288	0.05700	0.99998	-0.00000	0.00372	0.00568
0.80	0.21638	12.76369	-0.05199	0.01254	0.32496	3.61908	1.80431	0.00631	0.00001	-0.06609	0.03065	0.05853
0.80	0.30110	10.15610	-0.12785	0.01575	0.79908	1.87038	2.36037	0.06334	0.99975	-0.00002	0.00278	0.00575
0.90	0.21638	12.76371	-0.05199	0.01254	0.32496	3.61909	1.80431	0.00631	0.00001	-0.06609	0.03065	0.05853
0.90	0.31534	8.77930	-0.14406	0.01822	0.90040	1.37339	2.67846	0.07218	1.00224	0.00017	0.00218	0.00497

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.150 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.21673	4.30656	-0.00799	0.01858	0.09992	5.05319	2.32385	0.04671	0.99991	-0.00000	0.01126	-0.00314
0.10	0.22871	4.19530	-0.02566	0.01907	0.32070	4.68375	2.43470	0.04882	0.00005	-0.03648	0.01047	0.03390
0.20	0.22871	4.19526	-0.02566	0.01907	0.32072	4.68371	2.43472	0.04882	0.00000	-0.03648	0.01047	0.03391
0.20	0.22881	4.27294	-0.01598	0.01872	0.19980	4.79427	2.37040	0.05736	1.00000	0.00000	0.00732	-0.00110
0.30	0.22871	4.19526	-0.02566	0.01907	0.32071	4.68370	2.43472	0.04883	0.00012	-0.03647	0.01047	0.03390
0.30	0.23554	4.23248	-0.02398	0.01890	0.29970	4.61841	2.41534	0.06281	0.99981	-0.00001	0.00547	-0.00010
0.40	0.22871	4.19527	-0.02566	0.01907	0.32072	4.68370	2.43471	0.04883	0.00010	-0.03647	0.01047	0.03390
0.40	0.24049	4.17727	-0.03197	0.01915	0.39959	4.46609	2.46612	0.06674	0.99990	-0.00000	0.00431	0.00055
0.50	0.22871	4.19526	-0.02566	0.01907	0.32073	4.68369	2.43472	0.04883	0.00005	-0.03648	0.01047	0.03390
0.50	0.24505	4.07960	-0.03996	0.01961	0.49948	4.29721	2.53991	0.07045	0.99995	-0.00000	0.00347	0.00102
0.60	0.22871	4.19527	-0.02566	0.01907	0.32073	4.68369	2.43472	0.04883	0.00005	-0.03648	0.01047	0.03390
0.60	0.25061	4.00875	-0.04795	0.01996	0.59939	4.12827	2.60098	0.07500	0.99997	-0.00000	0.00233	0.00163
0.70	0.22871	4.19529	-0.02566	0.01907	0.32074	4.68369	2.43471	0.04883	0.00006	-0.03648	0.01047	0.03390
0.70	0.25453	3.91754	-0.05594	0.02042	0.69929	3.97597	2.67328	0.07813	0.99994	-0.00000	0.00179	0.00193
0.80	0.22871	4.19526	-0.02566	0.01907	0.32073	4.68368	2.43473	0.04883	0.00004	-0.03648	0.01047	0.03390
0.80	0.25849	3.78845	-0.06397	0.02112	0.79958	3.80094	2.77149	0.08145	1.00080	0.00003	0.00141	0.00208
0.90	0.22871	4.19527	-0.02566	0.01907	0.32074	4.68369	2.43472	0.04883	0.00004	-0.03643	0.01047	0.03390
0.90	0.26347	3.56136	-0.07161	0.02246	0.89518	3.54489	2.93965	0.08594	0.99324	-0.00026	0.00120	0.00237

CL= 0.10

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.20645	5.36628	-0.00999	0.01863	0.09992	5.24219	2.34703	0.03950	0.99992	-0.00000	0.01390	-0.00387
0.10	0.22143	5.18403	-0.03205	0.01929	0.32048	4.78102	2.48850	0.04196	0.00003	-0.04584	0.01275	0.04271
0.20	0.22143	5.18396	-0.03205	0.01929	0.32049	4.78097	2.48853	0.04196	0.00000	-0.04584	0.01275	0.04271
0.20	0.22157	5.31001	-0.01998	0.01883	0.19980	4.91854	2.40632	0.05281	1.00000	0.00000	0.00898	-0.00135
0.30	0.22143	5.18397	-0.03205	0.01929	0.32048	4.78095	2.48852	0.04196	0.00011	-0.04584	0.01275	0.04271
0.30	0.22999	5.24258	-0.02997	0.01907	0.29970	4.69872	2.46390	0.05963	0.99987	-0.00001	0.00669	-0.00013
0.40	0.22143	5.18397	-0.03205	0.01929	0.32049	4.78095	2.48853	0.04196	0.00006	-0.04584	0.01275	0.04271
0.40	0.23619	5.15156	-0.03996	0.01941	0.39959	4.50831	2.52929	0.06454	0.99994	-0.00000	0.00525	0.00065
0.50	0.22143	5.18398	-0.03205	0.01929	0.32050	4.78096	2.48852	0.04196	0.00006	-0.04584	0.01275	0.04271
0.50	0.24194	4.99404	-0.04995	0.02002	0.49948	4.29722	2.62474	0.06917	0.99996	-0.00000	0.00420	0.00120
0.60	0.22143	5.18399	-0.03205	0.01929	0.32050	4.78095	2.48852	0.04196	0.00005	-0.04584	0.01275	0.04271
0.60	0.24892	4.87865	-0.05994	0.02050	0.59939	4.08602	2.70434	0.07489	0.99996	-0.00000	0.00284	0.00190
0.70	0.22143	5.18397	-0.03205	0.01929	0.32050	4.78094	2.48853	0.04196	0.00004	-0.04584	0.01275	0.04271
0.70	0.25387	4.73319	-0.06993	0.02113	0.69926	3.89562	2.79893	0.07880	0.99989	-0.00001	0.00220	0.00222
0.80	0.22143	5.18397	-0.03205	0.01929	0.32050	4.78095	2.48853	0.04196	0.00003	-0.04584	0.01275	0.04271
0.80	0.25888	4.53078	-0.07987	0.02207	0.79875	3.67737	2.92731	0.08291	0.99907	-0.00004	0.00176	0.00242
0.90	0.22143	5.18398	-0.03205	0.01929	0.32051	4.78096	2.48852	0.04196	0.00004	-0.04584	0.01275	0.04271
0.90	0.26551	4.18993	-0.08963	0.02387	0.89632	3.35431	3.14905	0.08861	0.99522	-0.00023	0.00148	0.00256

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.150 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
CL= 0.12												
0.10	0.19617	6.41767	-0.01199	0.01870	0.09991	5.43119	2.37057	0.03224	0.99994	-0.00000	0.01646	-0.00457
0.10	0.21415	6.14406	-0.03843	0.01953	0.32026	4.87853	2.54383	0.03497	0.00003	-0.05530	0.01491	0.05163
0.20	0.21415	6.14398	-0.03843	0.01953	0.32026	4.87848	2.54387	0.03497	0.00000	-0.05530	0.01491	0.05164
0.20	0.21432	6.33147	-0.02398	0.01895	0.19980	5.04280	2.44306	0.04821	1.00000	0.00000	0.01057	-0.00158
0.30	0.21415	6.14398	-0.03843	0.01953	0.32026	4.87846	2.54387	0.03497	0.00008	-0.05529	0.01491	0.05163
0.30	0.22446	6.22869	-0.03596	0.01927	0.29970	4.77901	2.51386	0.05640	0.99990	-0.00001	0.00784	-0.00015
0.40	0.21415	6.14397	-0.03843	0.01953	0.32027	4.87846	2.54387	0.03497	0.00004	-0.05530	0.01491	0.05163
0.40	0.23192	6.09156	-0.04795	0.01970	0.39959	4.55052	2.59464	0.06229	0.99994	-0.00000	0.00614	0.00075
0.50	0.21415	6.14400	-0.03843	0.01953	0.32027	4.87846	2.54386	0.03497	0.00005	-0.05530	0.01491	0.05163
0.50	0.23986	5.85935	-0.05994	0.02049	0.49948	4.29721	2.71302	0.06784	0.99997	-0.00000	0.00489	0.00135
0.60	0.21415	6.14402	-0.03843	0.01953	0.32027	4.87847	2.54386	0.03497	0.00004	-0.05530	0.01491	0.05163
0.60	0.24728	5.68896	-0.07193	0.02109	0.59939	4.04379	2.81243	0.07473	0.99997	-0.00000	0.00331	0.00212
0.70	0.21415	6.14398	-0.03843	0.01953	0.32027	4.87846	2.54387	0.03497	0.00002	-0.05530	0.01491	0.05164
0.70	0.25327	5.47706	-0.08391	0.02191	0.69924	3.81518	2.93107	0.07944	0.99982	-0.00001	0.00253	0.00246
0.80	0.21415	6.14398	-0.03843	0.01953	0.32027	4.87845	2.54387	0.03497	0.00003	-0.05530	0.01491	0.05164
0.80	0.25937	5.18745	-0.09583	0.02313	0.79862	3.55206	3.09382	0.08440	0.99880	-0.00007	0.00208	0.00265
0.90	0.21415	6.14402	-0.03843	0.01953	0.32028	4.87847	2.54386	0.03497	0.00003	-0.05530	0.01491	0.05163
0.90	0.26770	4.75243	-0.10857	0.02525	0.90477	3.17172	3.37067	0.09160	1.00976	0.00057	0.00159	0.00200
CL= 0.14												
0.10	0.19589	7.46009	-0.01399	0.01877	0.09991	5.62020	2.39447	0.02492	0.99994	-0.00000	0.01895	-0.00525
0.10	0.20688	7.07364	-0.04481	0.01979	0.32004	4.97625	2.60072	0.02787	0.00001	-0.06484	0.01695	0.06068
0.20	0.20688	7.07351	-0.04481	0.01979	0.32005	4.97620	2.60076	0.02787	0.00000	-0.06484	0.01695	0.06068
0.20	0.20709	7.33596	-0.02797	0.01908	0.19980	5.16707	2.48061	0.04356	1.00000	0.00000	0.01211	-0.00180
0.30	0.20688	7.07353	-0.04481	0.01979	0.32004	4.97619	2.60075	0.02787	0.00007	-0.06484	0.01695	0.06067
0.30	0.21893	7.18888	-0.04196	0.01947	0.29970	4.85931	2.56521	0.05311	0.99992	-0.00001	0.00894	-0.00017
0.40	0.20688	7.07351	-0.04481	0.01979	0.32005	4.97618	2.60076	0.02787	0.00005	-0.06484	0.01695	0.06068
0.40	0.22767	6.99503	-0.05594	0.02001	0.39959	4.59274	2.66215	0.05999	0.99995	-0.00000	0.00697	0.00083
0.50	0.20688	7.07354	-0.04481	0.01979	0.32005	4.97620	2.60075	0.02787	0.00004	-0.06484	0.01695	0.06068
0.50	0.23581	6.67380	-0.06993	0.02098	0.49948	4.29722	2.80477	0.06646	0.99998	-0.00000	0.00553	0.00146
0.60	0.20688	7.07357	-0.04481	0.01979	0.32006	4.97620	2.60074	0.02787	0.00004	-0.06484	0.01695	0.06068
0.60	0.24569	6.43800	-0.08392	0.02175	0.59940	4.00155	2.92531	0.07454	1.00000	-0.00000	0.00376	0.00231
0.70	0.20688	7.07351	-0.04481	0.01979	0.32005	4.97618	2.60076	0.02787	0.00002	-0.06484	0.01695	0.06068
0.70	0.25273	6.15058	-0.09790	0.02276	0.69927	3.73494	3.06955	0.08005	0.99991	-0.00001	0.00293	0.00264
0.80	0.20688	7.07353	-0.04481	0.01979	0.32006	4.97618	2.60075	0.02787	0.00002	-0.06484	0.01695	0.06068
0.80	0.25998	5.76832	-0.11194	0.02427	0.79955	3.42768	3.26758	0.08590	1.00073	0.00005	0.00235	0.00270
0.90	0.20688	7.07358	-0.04481	0.01979	0.32006	4.97620	2.60074	0.02787	0.00003	-0.06484	0.01695	0.06068
0.90	0.26984	5.17272	-0.12652	0.02707	0.90375	2.97079	3.61469	0.09444	1.00799	0.00055	0.00185	0.00210

5 July 1977
BRP:JF:jep

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.150 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.17562	8.49278	-0.01599	0.01884	0.09991	5.80921	2.41874	0.01755	0.99995	-0.00000	0.02138	-0.00591
0.10	0.19962	7.97126	-0.05117	0.02007	0.31984	5.07419	2.65916	0.02065	0.00000	-0.07447	0.01887	0.06983
0.20	0.19962	7.97113	-0.05117	0.02007	0.31984	5.07413	2.65919	0.02065	0.00000	-0.07447	0.01887	0.06983
0.20	0.19987	8.32217	-0.03197	0.01923	0.19980	5.29134	2.51900	0.03886	1.00000	0.00000	0.01358	-0.00201
0.30	0.19962	7.97115	-0.05117	0.02007	0.31983	5.07413	2.65919	0.02065	0.00007	-0.07447	0.01887	0.06983
0.30	0.21342	8.12143	-0.04795	0.01970	0.29970	4.93962	2.61797	0.04978	0.99992	-0.00001	0.00999	-0.00020
0.40	0.19962	7.97113	-0.05117	0.02007	0.31984	5.07413	2.65919	0.02065	0.00004	-0.07447	0.01887	0.06983
0.40	0.22344	7.86020	-0.06393	0.02036	0.39959	4.63496	2.73186	0.05765	0.99995	-0.00000	0.00776	0.00090
0.50	0.19962	7.97116	-0.05117	0.02007	0.31984	5.07412	2.65919	0.02065	0.00004	-0.07447	0.01887	0.06983
0.50	0.23280	7.43636	-0.07992	0.02152	0.49948	4.29720	2.90001	0.06504	0.99997	-0.00000	0.00613	0.00160
0.60	0.19962	7.97111	-0.05117	0.02007	0.31984	5.07412	2.65920	0.02065	0.00002	-0.07447	0.01887	0.06983
0.60	0.24413	7.12604	-0.09590	0.02245	0.59939	3.95932	3.04296	0.07430	0.99996	-0.00000	0.00417	0.00247
0.70	0.19962	7.97114	-0.05118	0.02007	0.31985	5.07412	2.65920	0.02065	0.00003	-0.07447	0.01887	0.06983
0.70	0.25226	6.75499	-0.11190	0.02369	0.69935	3.65452	3.21454	0.08063	1.00011	0.00001	0.00325	0.00278
0.80	0.19962	7.97116	-0.05118	0.02007	0.31985	5.07413	2.65919	0.02065	0.00002	-0.07447	0.01887	0.06983
0.80	0.26063	6.26789	-0.12786	0.02553	0.79913	3.30228	3.45240	0.08730	0.99986	-0.00001	0.00263	0.00287
0.90	0.19962	7.97118	-0.05118	0.02007	0.31985	5.07413	2.65919	0.02065	0.00003	-0.07447	0.01887	0.06983
0.90	0.27187	5.56069	-0.14435	0.02877	0.90220	2.79685	3.84841	0.09664	1.00533	0.00042	0.00210	0.00228

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.150 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.20723	2.97236	-0.00799	0.02691	0.09993	6.48558	3.32593	0.06847	0.99987	-0.00000	0.00723	-0.00189
0.10	0.21637	2.87267	-0.02542	0.02785	0.31776	6.12273	3.47881	0.07034	0.00008	-0.03907	0.00695	0.03736
0.20	0.21637	2.87265	-0.02542	0.02785	0.31778	6.12263	3.47884	0.07034	0.00000	-0.03907	0.00695	0.03736
0.20	0.21646	2.93341	-0.01598	0.02727	0.19980	6.22666	3.39273	0.08022	1.00000	0.00000	0.00480	-0.00067
0.30	0.21637	2.87265	-0.02542	0.02785	0.31778	6.12267	3.47884	0.07034	0.00016	-0.03906	0.00695	0.03735
0.30	0.22166	2.89417	-0.02398	0.02764	0.29970	6.05081	3.45606	0.08619	0.99981	-0.00001	0.00368	-0.00008
0.40	0.21637	2.87264	-0.02542	0.02785	0.31779	6.12266	3.47885	0.07034	0.00010	-0.03907	0.00695	0.03735
0.40	0.22554	2.84810	-0.03197	0.02809	0.39958	5.89849	3.52618	0.09045	0.99989	-0.00000	0.00299	0.00029
0.50	0.21637	2.87265	-0.02542	0.02785	0.31780	6.12266	3.47885	0.07034	0.00008	-0.03907	0.00695	0.03736
0.50	0.22918	2.77849	-0.03996	0.02879	0.49948	5.72961	3.62533	0.09440	0.99993	-0.00000	0.00248	0.00054
0.60	0.21637	2.87265	-0.02542	0.02785	0.31780	6.12265	3.47885	0.07034	0.00006	-0.03907	0.00695	0.03735
0.60	0.23353	2.72592	-0.04795	0.02935	0.59938	5.56066	3.70777	0.09927	0.99992	-0.00000	0.00178	0.00090
0.70	0.21637	2.87265	-0.02542	0.02785	0.31781	6.12266	3.47884	0.07034	0.00006	-0.03907	0.00695	0.03736
0.70	0.23666	2.66352	-0.05594	0.03004	0.69926	5.40841	3.80356	0.10255	0.99988	-0.00000	0.00146	0.00106
0.80	0.21637	2.87264	-0.02542	0.02785	0.31780	6.12264	3.47885	0.07034	0.00005	-0.03907	0.00695	0.03736
0.80	0.23987	2.57986	-0.06393	0.03101	0.79909	5.23282	3.93182	0.10597	0.99977	-0.00001	0.00122	0.00117
0.90	0.21637	2.87264	-0.02542	0.02785	0.31781	6.12264	3.47885	0.07034	0.00004	-0.03907	0.00695	0.03736
0.90	0.24394	2.45125	-0.07219	0.03264	0.90233	4.98350	4.14306	0.11083	1.00555	0.00022	0.00099	0.00099

CL= 0.10

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.19961	3.69260	-0.00999	0.02708	0.09992	6.67458	3.35957	0.06049	0.99990	-0.00000	0.00893	-0.00234
0.10	0.21103	3.53574	-0.03176	0.02828	0.31764	6.22137	3.55358	0.06272	0.00006	-0.04899	0.00849	0.04690
0.20	0.21104	3.53571	-0.03177	0.02828	0.31765	6.22132	3.55361	0.06272	0.00000	-0.04899	0.00849	0.04690
0.20	0.21115	3.63091	-0.01998	0.02754	0.19980	6.35093	3.44421	0.07519	1.00000	0.00000	0.00590	-0.00082
0.30	0.21104	3.53572	-0.03176	0.02828	0.31765	6.22131	3.55361	0.06272	0.00013	-0.04898	0.00849	0.04689
0.30	0.21766	3.56890	-0.02997	0.02802	0.29970	6.13112	3.52478	0.08265	0.99985	-0.00001	0.00451	-0.00010
0.40	0.21104	3.53571	-0.03177	0.02828	0.31766	6.22130	3.55361	0.06272	0.00009	-0.04899	0.00849	0.04689
0.40	0.22251	3.49646	-0.03996	0.02860	0.39959	5.94070	3.61433	0.08797	0.99990	-0.00000	0.00364	0.00034
0.50	0.21104	3.53571	-0.03177	0.02828	0.31766	6.22130	3.55361	0.06272	0.00007	-0.04899	0.00849	0.04690
0.50	0.22709	3.38824	-0.04995	0.02951	0.49948	5.72961	3.74141	0.09290	0.99993	-0.00000	0.00301	0.00064
0.60	0.21104	3.53571	-0.03177	0.02828	0.31767	6.22130	3.55361	0.06272	0.00005	-0.04899	0.00849	0.04690
0.60	0.23253	3.30662	-0.05994	0.03024	0.59939	5.51843	3.84763	0.09900	0.99995	-0.00000	0.00216	0.00106
0.70	0.21104	3.53572	-0.03177	0.02828	0.31767	6.22130	3.55361	0.06272	0.00005	-0.04899	0.00849	0.04690
0.70	0.23648	3.21067	-0.06993	0.03115	0.69931	5.32792	3.97154	0.10311	1.00002	0.00000	0.00176	0.00124
0.80	0.21104	3.53570	-0.03177	0.02828	0.31767	6.22128	3.55362	0.06272	0.00004	-0.04899	0.00849	0.04690
0.80	0.24054	3.08511	-0.07997	0.03241	0.79972	5.10884	4.13800	0.10742	1.00108	0.00005	0.00147	0.00126
0.90	0.21104	3.53570	-0.03177	0.02828	0.31767	6.22128	3.55363	0.06272	0.00003	-0.04899	0.00849	0.04690
0.90	0.24598	2.89846	-0.09105	0.03450	0.91049	4.79267	4.41837	0.11377	1.01956	0.00098	0.00114	0.00042

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.150 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
CL= 0.12												
0.10	0.19198	4.40331	-0.01199	0.02725	0.09992	6.86358	3.39359	0.05248	0.99991	-0.00001	0.01059	-0.00277
0.10	0.20570	4.17621	-0.03810	0.02873	0.31751	6.32015	3.62988	0.05502	0.00006	-0.05895	0.00995	0.05651
0.20	0.20570	4.17617	-0.03810	0.02873	0.31752	6.32010	3.62991	0.05502	0.00000	-0.05896	0.00995	0.05651
0.20	0.20585	4.31341	-0.02398	0.02782	0.19980	6.47520	3.49652	0.07012	1.00000	0.00000	0.00696	-0.00096
0.30	0.20570	4.17618	-0.03810	0.02873	0.31752	6.32008	3.62990	0.05502	0.00012	-0.05896	0.00995	0.05650
0.30	0.21367	4.22325	-0.03596	0.02841	0.29970	6.21141	3.59491	0.07908	0.99986	-0.00001	0.00529	-0.00012
0.40	0.20570	4.17617	-0.03810	0.02873	0.31753	6.32008	3.62992	0.05502	0.00006	-0.05896	0.00995	0.05651
0.40	0.21950	4.11859	-0.04795	0.02914	0.39959	5.98293	3.70463	0.08546	0.99992	-0.00000	0.00426	0.00039
0.50	0.20570	4.17617	-0.03810	0.02873	0.31753	6.32008	3.62992	0.05502	0.00005	-0.05896	0.00995	0.05651
0.50	0.22501	3.96398	-0.05994	0.03027	0.49948	5.72962	3.86089	0.09137	0.99995	-0.00000	0.00351	0.00073
0.60	0.20570	4.17617	-0.03810	0.02873	0.31754	6.32007	3.62991	0.05502	0.00005	-0.05896	0.00995	0.05651
0.60	0.23157	3.84773	-0.07193	0.03119	0.59940	5.47621	3.99216	0.09871	0.99998	-0.00000	0.00251	0.00120
0.70	0.20570	4.17616	-0.03810	0.02873	0.31754	6.32006	3.62993	0.05502	0.00003	-0.05896	0.00995	0.05651
0.70	0.23631	3.71262	-0.08391	0.03232	0.69924	5.24777	4.14577	0.10363	0.99983	-0.00001	0.00205	0.00140
0.80	0.20570	4.17617	-0.03810	0.02873	0.31754	6.32007	3.62992	0.05502	0.00003	-0.05896	0.00995	0.05651
0.80	0.24121	3.53697	-0.09589	0.03393	0.79911	4.98442	4.35305	0.10878	0.99983	-0.00001	0.00172	0.00149
0.90	0.20570	4.17616	-0.03810	0.02873	0.31754	6.32006	3.62993	0.05502	0.00003	-0.05896	0.00995	0.05651
0.90	0.24778	3.26889	-0.10758	0.03671	0.89646	4.60375	4.69672	0.11558	0.99548	-0.00028	0.00147	0.00172
CL= 0.14												
0.10	0.18436	5.10434	-0.01399	0.02743	0.09992	7.05258	3.42799	0.04444	0.99992	-0.00001	0.01220	-0.00319
0.10	0.20037	4.79400	-0.04443	0.02920	0.31739	6.41905	3.70772	0.04724	0.00005	-0.06899	0.01134	0.06619
0.20	0.20038	4.79395	-0.04444	0.02920	0.31740	6.41901	3.70775	0.04724	0.00000	-0.06899	0.01134	0.06620
0.20	0.20054	4.98064	-0.02797	0.02811	0.19980	6.59948	3.54967	0.06502	1.00000	0.00000	0.00798	-0.00110
0.30	0.20038	4.79396	-0.04444	0.02920	0.31740	6.41899	3.70774	0.04724	0.00009	-0.06898	0.01134	0.06619
0.30	0.20968	4.85699	-0.04196	0.02882	0.29970	6.29172	3.66643	0.07547	0.99988	-0.00001	0.00605	-0.00014
0.40	0.20038	4.79395	-0.04444	0.02920	0.31740	6.41898	3.70775	0.04724	0.00005	-0.06899	0.01134	0.06619
0.40	0.21650	4.71440	-0.05594	0.02970	0.39959	6.02515	3.79710	0.08291	0.99994	-0.00000	0.00465	0.00044
0.50	0.20038	4.79395	-0.04444	0.02920	0.31741	6.41899	3.70775	0.04724	0.00004	-0.06899	0.01134	0.06619
0.50	0.22295	4.50622	-0.06993	0.03107	0.49948	5.72961	3.98378	0.08981	0.99996	-0.00000	0.00397	0.00081
0.60	0.20038	4.79396	-0.04444	0.02920	0.31741	6.41898	3.70775	0.04724	0.00004	-0.06899	0.01134	0.06619
0.60	0.23062	4.35025	-0.08392	0.03218	0.59939	5.43395	4.14137	0.09839	0.99997	-0.00000	0.00284	0.00132
0.70	0.20038	4.79394	-0.04444	0.02920	0.31741	6.41897	3.70776	0.04724	0.00003	-0.06899	0.01134	0.06619
0.70	0.23619	4.17117	-0.09790	0.03356	0.69930	5.16739	4.32629	0.10415	0.99999	-0.00000	0.00231	0.00152
0.80	0.20038	4.79394	-0.04444	0.02920	0.31741	6.41897	3.70776	0.04724	0.00002	-0.06899	0.01134	0.06619
0.80	0.24197	3.94093	-0.11190	0.03552	0.79925	4.85935	4.57672	0.11016	1.00012	0.00001	0.00193	0.00159
0.90	0.20038	4.79394	-0.04444	0.02920	0.31741	6.41897	3.70776	0.04724	0.00002	-0.06899	0.01134	0.06619
0.90	0.24920	3.61582	-0.12602	0.03872	0.90014	4.43443	4.95569	0.11810	1.00179	0.00013	0.00161	0.00144

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.150 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.17674	5.79552	-0.01599	0.02761	0.09991	7.24159	3.46276	0.03636	0.99993	-0.00001	0.01378	-0.00360
0.10	0.19505	5.38910	-0.05076	0.02969	0.31727	6.51808	3.78709	0.03940	0.00005	-0.07907	0.01266	0.07594
0.20	0.19505	5.38906	-0.05076	0.02969	0.31728	6.51804	3.78712	0.03940	0.00000	-0.07907	0.01266	0.07595
0.20	0.19525	5.63240	-0.03197	0.02841	0.19980	6.72375	3.60365	0.05988	1.00000	0.00000	0.00897	-0.00123
0.30	0.19505	5.38908	-0.05076	0.02969	0.31728	6.51802	3.78711	0.03940	0.00010	-0.07906	0.01266	0.07594
0.30	0.20570	5.46998	-0.04795	0.02925	0.29970	6.37202	3.73935	0.07183	0.99990	-0.00001	0.00677	-0.00015
0.40	0.19505	5.38907	-0.05077	0.02969	0.31729	6.51801	3.78712	0.03940	0.00005	-0.07906	0.01266	0.07594
0.40	0.21351	5.28396	-0.06393	0.03028	0.39959	6.06737	3.89172	0.08034	0.99994	-0.00001	0.00541	0.00048
0.50	0.19505	5.38907	-0.05077	0.02969	0.31729	6.51802	3.78712	0.03940	0.00004	-0.07907	0.01266	0.07594
0.50	0.22091	5.01566	-0.07992	0.03190	0.49948	5.72961	4.11006	0.08821	0.99996	-0.00000	0.00440	0.00088
0.60	0.19505	5.38908	-0.05077	0.02969	0.31729	6.51802	3.78712	0.03940	0.00004	-0.07907	0.01266	0.07594
0.60	0.22969	4.81558	-0.09590	0.03323	0.59939	5.39174	4.29520	0.09804	0.99997	-0.00000	0.00315	0.00143
0.70	0.19505	5.38905	-0.05077	0.02969	0.31729	6.51801	3.78713	0.03940	0.00002	-0.07907	0.01266	0.07595
0.70	0.23609	4.58847	-0.11189	0.03487	0.69929	5.08708	4.51303	0.10463	0.99997	-0.00000	0.00256	0.00163
0.80	0.19505	5.38905	-0.05077	0.02969	0.31729	6.51801	3.78713	0.03940	0.00002	-0.07907	0.01266	0.07595
0.80	0.24273	4.30249	-0.12793	0.03719	0.79954	4.73622	4.80614	0.11151	1.00071	0.00006	0.00212	0.00164
0.90	0.19505	5.38905	-0.05077	0.02969	0.31729	6.51800	3.78713	0.03940	0.00002	-0.07907	0.01266	0.07595
0.90	0.25184	3.87205	-0.14407	0.04132	0.90044	4.21661	5.30691	0.12110	1.00230	0.00019	0.00176	0.00144

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.200 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.29466	4.34413	-0.00799	0.01842	0.09991	3.58929	1.35259	0.03194	0.99994	-0.00000	0.02627	-0.00890
0.10	0.31126	4.45436	-0.02654	0.01796	0.33178	3.21211	1.38711	0.03443	0.00006	-0.02696	0.02213	0.02136
0.20	0.31126	4.45436	-0.02654	0.01796	0.33179	3.21207	1.38711	0.03443	0.00000	-0.02697	0.02213	0.02137
0.20	0.31121	4.40651	-0.01598	0.01815	0.19980	3.34116	1.36524	0.03893	1.00000	0.00000	0.01619	-0.00351
0.30	0.31126	4.45435	-0.02654	0.01796	0.33179	3.21207	1.38711	0.03443	0.00010	-0.02696	0.02213	0.02136
0.30	0.32009	4.45751	-0.02398	0.01795	0.29970	3.17262	1.37799	0.04261	0.99985	-0.00000	0.01124	-0.00060
0.40	0.31126	4.45437	-0.02654	0.01796	0.33180	3.21208	1.38711	0.03443	0.00006	-0.02696	0.02213	0.02137
0.40	0.32632	4.49979	-0.03197	0.01778	0.39959	3.02665	1.39321	0.04537	0.99992	-0.00000	0.00792	0.00161
0.50	0.31126	4.45437	-0.02654	0.01796	0.33180	3.21207	1.38711	0.03443	0.00004	-0.02696	0.02213	0.02137
0.50	0.33160	4.51416	-0.03996	0.01772	0.49948	2.86481	1.41754	0.04816	0.99995	-0.00000	0.00535	0.00361
0.60	0.31126	4.45438	-0.02654	0.01796	0.33180	3.21207	1.38711	0.03443	0.00003	-0.02696	0.02213	0.02137
0.60	0.33859	4.53516	-0.04795	0.01764	0.59939	2.70291	1.43707	0.05146	0.99996	-0.00000	0.00216	0.00566
0.70	0.31126	4.45437	-0.02654	0.01796	0.33180	3.21206	1.38711	0.03443	0.00003	-0.02696	0.02213	0.02137
0.70	0.34307	4.53370	-0.05595	0.01765	0.69936	2.55680	1.46154	0.05393	1.00015	0.00000	0.00048	0.00701
0.80	0.31126	4.45437	-0.02654	0.01796	0.33180	3.21207	1.38711	0.03443	0.00003	-0.02696	0.02213	0.02137
0.80	0.34722	4.49019	-0.06394	0.01782	0.79921	2.38877	1.49698	0.05673	1.00003	0.00000	-0.00072	0.00812
0.90	0.31126	4.45441	-0.02654	0.01796	0.33181	3.21209	1.38710	0.03443	0.00004	-0.02696	0.02213	0.02137
0.90	0.35175	4.33238	-0.07171	0.01846	0.89632	2.14772	1.56158	0.06084	0.99513	-0.00014	-0.00132	0.00884

CL= 0.10

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.27946	5.47194	-0.00999	0.01828	0.09991	3.77042	1.35872	0.02728	0.99995	-0.00000	0.03250	-0.01093
0.10	0.30021	5.63193	-0.03314	0.01776	0.33137	3.29998	1.40317	0.03018	0.00005	-0.03404	0.02709	0.02720
0.20	0.30021	5.63192	-0.03314	0.01776	0.33138	3.29995	1.40317	0.03018	0.00000	-0.03404	0.02709	0.02720
0.20	0.30016	5.56684	-0.01998	0.01796	0.19980	3.46025	1.37495	0.03602	1.00000	0.00000	0.01994	-0.00429
0.30	0.30021	5.63192	-0.03314	0.01776	0.33138	3.29995	1.40317	0.03019	0.00008	-0.03404	0.02708	0.02720
0.30	0.31129	5.64216	-0.02997	0.01772	0.29970	3.24957	1.39145	0.04063	0.99990	-0.00000	0.01380	-0.00071
0.40	0.30021	5.63192	-0.03314	0.01776	0.33138	3.29995	1.40317	0.03019	0.00004	-0.03404	0.02708	0.02720
0.40	0.31910	5.70040	-0.03996	0.01754	0.39959	3.06710	1.41132	0.04408	0.99994	-0.00000	0.00972	0.00197
0.50	0.30021	5.63194	-0.03314	0.01776	0.33138	3.29996	1.40317	0.03019	0.00004	-0.03404	0.02708	0.02720
0.50	0.32576	5.70577	-0.04995	0.01753	0.49943	2.86481	1.44333	0.04753	0.99995	-0.00000	0.00661	0.00430
0.60	0.30021	5.63194	-0.03314	0.01776	0.33139	3.29995	1.40317	0.03019	0.00003	-0.03404	0.02708	0.02720
0.60	0.33457	5.72220	-0.05994	0.01748	0.59939	2.66243	1.46934	0.05177	0.99997	-0.00000	0.00283	0.00666
0.70	0.30021	5.63193	-0.03314	0.01776	0.33139	3.29994	1.40318	0.03019	0.00002	-0.03404	0.02708	0.02720
0.70	0.34025	5.69658	-0.06993	0.01755	0.69932	2.47988	1.50216	0.05489	1.00004	0.00000	0.00090	0.00812
0.80	0.30021	5.63194	-0.03314	0.01776	0.33139	3.29995	1.40317	0.03019	0.00002	-0.03404	0.02708	0.02720
0.80	0.34561	5.59372	-0.07991	0.01788	0.79911	2.26949	1.55008	0.05843	0.99983	-0.00001	-0.00038	0.00919
0.90	0.30021	5.63198	-0.03314	0.01776	0.33139	3.29996	1.40317	0.03018	0.00003	-0.03404	0.02708	0.02720
0.90	0.35224	5.29641	-0.09006	0.01888	0.90056	1.95696	1.63980	0.06368	1.00255	0.00010	-0.00106	0.00944

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.200 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.12

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.26427	6.61565	-0.01199	0.01814	0.09991	3.95154	1.36498	0.02255	0.99996	-0.00000	0.03859	-0.01300
0.10	0.28916	6.82743	-0.03971	0.01758	0.33096	3.38828	1.41992	0.02579	0.00004	-0.04124	0.03182	0.03323
0.20	0.28916	6.82744	-0.03972	0.01758	0.33097	3.38825	1.41993	0.02579	0.00000	-0.04125	0.03182	0.03323
0.20	0.28913	6.74833	-0.02398	0.01778	0.19980	3.57934	1.38497	0.03306	1.00000	0.00000	0.02358	-0.00503
0.30	0.28916	6.82743	-0.03972	0.01758	0.33097	3.38824	1.41992	0.02579	0.00007	-0.04124	0.03182	0.03323
0.30	0.30251	6.84997	-0.03596	0.01752	0.29970	3.32653	1.40547	0.03859	0.99990	-0.00000	0.01627	-0.00060
0.40	0.28916	6.82744	-0.03972	0.01758	0.33097	3.38824	1.41993	0.02579	0.00004	-0.04125	0.03182	0.03323
0.40	0.31192	6.92173	-0.04795	0.01734	0.39959	3.10756	1.43037	0.04274	0.99995	-0.00000	0.01146	0.00230
0.50	0.28916	6.82746	-0.03972	0.01758	0.33097	3.38824	1.41992	0.02579	0.00004	-0.04125	0.03182	0.03323
0.50	0.31999	6.90410	-0.05994	0.01738	0.49948	2.86481	1.47074	0.04695	0.99996	-0.00000	0.00784	0.00490
0.60	0.28916	6.82746	-0.03972	0.01758	0.33097	3.38824	1.41992	0.02579	0.00002	-0.04125	0.03182	0.03323
0.60	0.33063	6.90349	-0.07193	0.01738	0.59940	2.62194	1.50396	0.05204	0.99999	-0.00000	0.00352	0.00751
0.70	0.28916	6.82745	-0.03972	0.01758	0.33098	3.38824	1.41993	0.02579	0.00002	-0.04125	0.03182	0.03323
0.70	0.33755	6.83382	-0.08392	0.01756	0.69931	2.40292	1.54613	0.05583	1.00001	0.00000	0.00140	0.00901
0.80	0.28916	6.82746	-0.03972	0.01758	0.33098	3.38824	1.41993	0.02579	0.00002	-0.04125	0.03182	0.03323
0.80	0.34412	6.63946	-0.09584	0.01807	0.79863	2.15129	1.60778	0.06009	0.99880	-0.00005	0.00010	0.01000
0.90	0.28916	6.82751	-0.03972	0.01758	0.33098	3.38825	1.41992	0.02579	0.00003	-0.04125	0.03182	0.03323
0.90	0.35280	6.15959	-0.10796	0.01948	0.89965	1.77532	1.72273	0.06665	1.00096	0.00004	-0.00053	0.00991

CL= 0.14

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.24908	7.77479	-0.01399	0.01801	0.09991	4.13267	1.37138	0.01777	0.99997	-0.00000	0.04455	-0.01497
0.10	0.27811	8.03657	-0.04628	0.01742	0.33055	3.47693	1.43738	0.02124	0.00004	-0.04859	0.03634	0.03945
0.20	0.27811	8.03656	-0.04628	0.01742	0.33056	3.47695	1.43738	0.02124	0.00000	-0.04859	0.03634	0.03945
0.20	0.27811	7.94953	-0.02797	0.01761	0.19980	3.69843	1.39530	0.03003	1.00000	0.00000	0.02709	-0.00573
0.30	0.27811	8.03657	-0.04628	0.01742	0.33056	3.47695	1.43738	0.02125	0.00005	-0.04859	0.03634	0.03945
0.30	0.29375	8.07792	-0.04196	0.01733	0.29970	3.40249	1.42006	0.03649	0.99993	-0.00000	0.01864	-0.00086
0.40	0.27811	8.03657	-0.04628	0.01742	0.33056	3.47695	1.43738	0.02125	0.00003	-0.04859	0.03634	0.03945
0.40	0.30477	8.15808	-0.05594	0.01716	0.39959	3.14803	1.45037	0.04135	0.99995	-0.00000	0.01312	0.00262
0.50	0.27811	8.03657	-0.04628	0.01742	0.33056	3.47695	1.43738	0.02125	0.00002	-0.04859	0.03634	0.03945
0.50	0.31428	8.09894	-0.06993	0.01729	0.49948	2.86480	1.49983	0.04626	0.99997	-0.00000	0.00902	0.00543
0.60	0.27811	8.03660	-0.04628	0.01742	0.33057	3.47695	1.43738	0.02125	0.00002	-0.04859	0.03634	0.03945
0.60	0.32678	8.06501	-0.08392	0.01736	0.59940	2.58146	1.54101	0.05228	0.99998	-0.00000	0.00423	0.00823
0.70	0.27811	8.03658	-0.04628	0.01742	0.33057	3.47694	1.43738	0.02125	0.00002	-0.04859	0.03634	0.03945
0.70	0.33498	7.92681	-0.09789	0.01766	0.69924	2.32586	1.59357	0.05674	0.99981	-0.00001	0.00196	0.00972
0.80	0.27811	8.03659	-0.04628	0.01742	0.33057	3.47695	1.43738	0.02125	0.00001	-0.04859	0.03634	0.03945
0.80	0.34295	7.61025	-0.11191	0.01840	0.79935	2.03023	1.67101	0.06182	1.00034	0.00002	0.00058	0.01049
0.90	0.27811	8.03665	-0.04628	0.01742	0.33057	3.47696	1.43737	0.02125	0.00002	-0.04859	0.03634	0.03945
0.90	0.35272	6.92026	-0.12586	0.02023	0.89902	1.60466	1.81260	0.06924	0.99986	-0.00001	0.00008	0.01016

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.200 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
CL= 0.16												
0.10	0.23390	8.94879	-0.01598	0.01788	0.09991	4.31380	1.37791	0.01292	0.99998	-0.00000	0.05038	-0.01688
0.10	0.26706	9.25476	-0.05282	0.01729	0.33015	3.56609	1.45556	0.01655	0.00003	-0.05606	0.04064	0.04586
0.20	0.26707	9.25474	-0.05283	0.01729	0.33016	3.56607	1.45556	0.01655	0.00000	-0.05606	0.04064	0.04587
0.20	0.26710	9.16887	-0.03197	0.01745	0.19980	3.81753	1.40596	0.02694	1.00000	0.00000	0.03049	-0.00640
0.30	0.26707	9.25473	-0.05282	0.01729	0.33016	3.56606	1.45556	0.01655	0.00003	-0.05606	0.04064	0.04586
0.30	0.28501	9.32266	-0.04795	0.01716	0.29970	3.48044	1.43525	0.03434	0.99993	-0.00000	0.02091	-0.00095
0.40	0.26707	9.25473	-0.05283	0.01729	0.33016	3.56607	1.45556	0.01655	0.00001	-0.05606	0.04064	0.04587
0.40	0.29765	9.40333	-0.06393	0.01702	0.39959	3.18848	1.47138	0.03990	0.99996	-0.00000	0.01472	0.00291
0.50	0.26707	9.25477	-0.05283	0.01729	0.33016	3.56606	1.45556	0.01655	0.00002	-0.05606	0.04064	0.04586
0.50	0.30863	9.28001	-0.07992	0.01724	0.49949	2.86479	1.53068	0.04552	0.99999	-0.00000	0.01017	0.00589
0.60	0.26707	9.25480	-0.05283	0.01729	0.33016	3.56606	1.45556	0.01655	0.00002	-0.05606	0.04064	0.04586
0.60	0.32301	9.19342	-0.09590	0.01740	0.59940	2.54101	1.58056	0.05248	0.99998	-0.00000	0.00496	0.00882
0.70	0.26707	9.25475	-0.05283	0.01729	0.33016	3.56605	1.45556	0.01655	0.00001	-0.05606	0.04064	0.04587
0.70	0.33253	8.96223	-0.11188	0.01785	0.69927	2.24891	1.64450	0.05763	0.99991	-0.00001	0.00255	0.01025
0.80	0.26707	9.25478	-0.05283	0.01729	0.33016	3.56606	1.45556	0.01655	0.00001	-0.05606	0.04064	0.04587
0.80	0.34183	8.48744	-0.12784	0.01885	0.79901	1.91038	1.73968	0.06349	0.99962	-0.00002	0.00116	0.01085
0.90	0.26707	9.25484	-0.05283	0.01729	0.33016	3.56607	1.45556	0.01655	0.00001	-0.05606	0.04064	0.04586
0.90	0.35384	7.54328	-0.14387	0.02121	0.89916	1.41814	1.91435	0.07208	1.00010	0.00001	0.00068	0.01013

5 July 1977
BRP:JF:jep

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.200 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
CL= 0.08												
0.10	0.24539	3.23290	-0.00799	0.02475	0.09992	5.02167	1.78603	0.05132	0.99992	-0.00000	0.01570	-0.00470
0.10	0.25668	3.21349	-0.02596	0.02490	0.32453	4.65951	1.84512	0.05370	0.00009	-0.03197	0.01425	0.02846
0.20	0.25668	3.21349	-0.02596	0.02490	0.32455	4.65948	1.84513	0.05370	0.00000	-0.03197	0.01425	0.02846
0.20	0.25675	3.23629	-0.01598	0.02472	0.19980	4.77355	1.80977	0.06036	1.00000	0.00000	0.01003	-0.00171
0.30	0.25668	3.21349	-0.02596	0.02490	0.32454	4.65947	1.84513	0.05370	0.00014	-0.03197	0.01425	0.02845
0.30	0.26298	3.23299	-0.02398	0.02474	0.29970	4.60502	1.83296	0.06503	0.99982	-0.00001	0.00733	-0.00017
0.40	0.25668	3.21349	-0.02596	0.02490	0.32455	4.65946	1.84513	0.05370	0.00009	-0.03197	0.01425	0.02846
0.40	0.26748	3.22030	-0.03197	0.02484	0.39958	4.45905	1.85959	0.06845	0.99989	-0.00000	0.00559	0.00091
0.50	0.25668	3.21349	-0.02596	0.02490	0.32456	4.65946	1.84513	0.05370	0.00006	-0.03197	0.01425	0.02845
0.50	0.27152	3.18187	-0.03996	0.02514	0.49948	4.29721	1.89935	0.07175	0.99993	-0.00000	0.00430	0.00177
0.60	0.25668	3.21349	-0.02596	0.02490	0.32456	4.65946	1.84513	0.05370	0.00005	-0.03197	0.01425	0.02846
0.60	0.27653	3.15716	-0.04795	0.02534	0.59938	4.13530	1.93173	0.07572	0.99993	-0.00000	0.00258	0.00279
0.70	0.25668	3.21349	-0.02597	0.02490	0.32456	4.65945	1.84513	0.05370	0.00004	-0.03197	0.01425	0.02846
0.70	0.28002	3.11774	-0.05594	0.02566	0.69927	3.98931	1.97066	0.07853	0.99989	-0.00000	0.00173	0.00337
0.80	0.25668	3.21349	-0.02597	0.02490	0.32456	4.65944	1.84513	0.05370	0.00004	-0.03197	0.01425	0.02846
0.80	0.28341	3.05160	-0.06394	0.02622	0.79925	3.82111	2.02457	0.08159	1.00010	0.00000	0.00113	0.00379
0.90	0.25668	3.21348	-0.02597	0.02490	0.32457	4.65944	1.84514	0.05370	0.00003	-0.03197	0.01425	0.02846
0.90	0.28763	2.92005	-0.07202	0.02740	0.90027	3.57364	2.11879	0.08604	1.00204	0.00007	0.00070	0.00394
CL= 0.10												
0.10	0.23542	4.04602	-0.00999	0.02472	0.09992	5.20280	1.79773	0.04528	0.99993	-0.00000	0.01943	-0.00581
0.10	0.24954	4.00870	-0.03243	0.02495	0.32427	4.75078	1.87314	0.04807	0.00007	-0.04021	0.01745	0.03591
0.20	0.24954	4.00870	-0.03243	0.02495	0.32428	4.75075	1.87315	0.04807	0.00000	-0.04021	0.01745	0.03591
0.20	0.24963	4.04889	-0.01998	0.02470	0.19980	4.89264	1.82796	0.05657	1.00000	0.00000	0.01236	-0.00209
0.30	0.24954	4.00870	-0.03243	0.02495	0.32428	4.75074	1.87315	0.04807	0.00011	-0.04020	0.01745	0.03591
0.30	0.25744	4.04057	-0.02997	0.02475	0.29970	4.68198	1.85768	0.06242	0.99987	-0.00001	0.00900	-0.00020
0.40	0.24954	4.00870	-0.03243	0.02495	0.32429	4.75073	1.87315	0.04807	0.00007	-0.04021	0.01745	0.03591
0.40	0.26308	4.01643	-0.03996	0.02490	0.39959	4.49950	1.89198	0.06669	0.99992	-0.00000	0.00685	0.00110
0.50	0.24954	4.00869	-0.03243	0.02495	0.32429	4.75072	1.87315	0.04807	0.00005	-0.04021	0.01745	0.03591
0.50	0.26816	3.94992	-0.04995	0.02532	0.49948	4.29720	1.94343	0.07081	0.99995	-0.00000	0.00527	0.00210
0.60	0.24954	4.00870	-0.03243	0.02495	0.32429	4.75073	1.87315	0.04807	0.00004	-0.04021	0.01745	0.03591
0.60	0.27452	3.90517	-0.05994	0.02561	0.59938	4.09482	1.98567	0.07581	0.99993	-0.00000	0.00320	0.00329
0.70	0.24954	4.00870	-0.03243	0.02495	0.32430	4.75072	1.87315	0.04807	0.00003	-0.04021	0.01745	0.03591
0.70	0.27887	3.83660	-0.06993	0.02606	0.69926	3.91232	2.03666	0.07934	0.99987	-0.00001	0.00220	0.00393
0.80	0.24954	4.00869	-0.03243	0.02495	0.32430	4.75072	1.87316	0.04807	0.00003	-0.04021	0.01745	0.03591
0.80	0.28318	3.72445	-0.07987	0.02685	0.79871	3.70166	2.10785	0.08316	0.99898	-0.00004	0.00152	0.00438
0.90	0.24954	4.00869	-0.03243	0.02495	0.32430	4.75072	1.87316	0.04807	0.00002	-0.04021	0.01745	0.03591
0.90	0.28863	3.51742	-0.08983	0.02843	0.89827	3.39699	2.23048	0.08857	0.99857	-0.00006	0.00108	0.00451

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.200 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
CL= 0.12												
0.10	0.22546	4.86018	-0.01199	0.02469	0.09991	5.38393	1.80962	0.03918	0.99995	-0.00000	0.02308	-0.00688
0.10	0.24240	4.79654	-0.03888	0.02502	0.32401	4.84231	1.90198	0.04232	0.00006	-0.04854	0.02052	0.04349
0.20	0.24240	4.79653	-0.03888	0.02502	0.32402	4.84227	1.90198	0.04232	0.00000	-0.04854	0.02052	0.04349
0.20	0.24252	4.86082	-0.02398	0.02469	0.19980	5.01173	1.84657	0.05274	1.00000	0.00000	0.01462	-0.00246
0.30	0.24240	4.79653	-0.03888	0.02502	0.32402	4.84227	1.90198	0.04232	0.00009	-0.04854	0.02052	0.04349
0.30	0.25190	4.84429	-0.03596	0.02477	0.29970	4.75893	1.88311	0.05976	0.99988	-0.00001	0.01061	-0.00023
0.40	0.24240	4.79653	-0.03888	0.02502	0.32403	4.84226	1.90198	0.04232	0.00004	-0.04854	0.02052	0.04349
0.40	0.25870	4.80348	-0.04795	0.02498	0.39959	4.53996	1.92550	0.06488	0.99993	-0.00000	0.00507	0.00127
0.50	0.24240	4.79653	-0.03888	0.02502	0.32403	4.84226	1.90198	0.04232	0.00004	-0.04854	0.02052	0.04349
0.50	0.26484	4.69906	-0.05994	0.02554	0.49948	4.29720	1.98935	0.06983	0.99995	-0.00000	0.00619	0.00240
0.60	0.24240	4.79653	-0.03888	0.02502	0.32403	4.84226	1.90198	0.04232	0.00003	-0.04854	0.02052	0.04349
0.60	0.27250	4.62664	-0.07193	0.02594	0.59940	4.05434	2.04218	0.07587	0.99999	-0.00000	0.00380	0.00372
0.70	0.24240	4.79653	-0.03888	0.02502	0.32403	4.84226	1.90198	0.04232	0.00002	-0.04854	0.02052	0.04349
0.70	0.27778	4.51933	-0.08391	0.02655	0.69927	3.83529	2.10625	0.08013	0.99991	-0.00000	0.00266	0.00439
0.80	0.24240	4.79653	-0.03888	0.02502	0.32403	4.84226	1.90199	0.04232	0.00002	-0.04854	0.02052	0.04349
0.80	0.28303	4.35158	-0.09591	0.02758	0.79921	3.58328	2.19558	0.08473	1.00003	0.00000	0.00189	0.00478
0.90	0.24240	4.79652	-0.03888	0.02502	0.32403	4.84225	1.90199	0.04232	0.00002	-0.04854	0.02052	0.04349
0.90	0.29011	4.04581	-0.10791	0.02966	0.89923	3.21119	2.35208	0.09134	1.00022	0.00001	0.00139	0.00477
CL= 0.14												
0.10	0.21550	5.67493	-0.01399	0.02467	0.09991	5.56505	1.82169	0.03303	0.99995	-0.00000	0.02665	-0.00793
0.10	0.23526	5.57509	-0.04533	0.02511	0.32376	4.93412	1.93162	0.03646	0.00006	-0.05697	0.02345	0.05120
0.20	0.23527	5.57509	-0.04533	0.02511	0.32377	4.93407	1.93163	0.03646	0.00000	-0.05697	0.02345	0.05120
0.20	0.23541	5.67102	-0.02797	0.02469	0.19980	5.13083	1.86559	0.04886	1.00000	0.00000	0.01681	-0.00281
0.30	0.23527	5.57509	-0.04533	0.02511	0.32377	4.93406	1.93163	0.03646	0.00010	-0.05697	0.02345	0.05119
0.30	0.24638	5.64241	-0.04196	0.02481	0.29970	4.83589	1.90926	0.05705	0.99990	-0.00001	0.01217	-0.00026
0.40	0.23527	5.57508	-0.04533	0.02511	0.32377	4.93405	1.93163	0.03646	0.00004	-0.05697	0.02345	0.05120
0.40	0.25433	5.57888	-0.05594	0.02509	0.39959	4.58043	1.96016	0.06303	0.99994	-0.00000	0.00923	0.00143
0.50	0.23527	5.57508	-0.04533	0.02511	0.32377	4.93405	1.93164	0.03646	0.00003	-0.05697	0.02345	0.05120
0.50	0.26155	5.42593	-0.06993	0.02580	0.49948	4.29721	2.03715	0.06879	0.99995	-0.00000	0.00708	0.00265
0.60	0.23527	5.57508	-0.04533	0.02511	0.32378	4.93404	1.93164	0.03646	0.00003	-0.05697	0.02345	0.05120
0.60	0.27054	5.31758	-0.08392	0.02633	0.59939	4.01386	2.10130	0.07589	0.99997	-0.00000	0.00439	0.00410
0.70	0.23527	5.57508	-0.04533	0.02511	0.32378	4.93404	1.93164	0.03646	0.00003	-0.05697	0.02345	0.05120
0.70	0.27676	5.16210	-0.09790	0.02712	0.69930	3.75837	2.17928	0.08088	0.99998	-0.00000	0.00312	0.00478
0.80	0.23527	5.57508	-0.04533	0.02511	0.32378	4.93404	1.93164	0.03646	0.00002	-0.05697	0.02345	0.05120
0.80	0.28302	4.92327	-0.11187	0.02844	0.79905	3.46300	2.28875	0.08627	0.99970	-0.00002	0.00229	0.00513
0.90	0.23527	5.57507	-0.04533	0.02511	0.32376	4.93404	1.93164	0.03646	0.00002	-0.05697	0.02345	0.05120
0.90	0.29160	4.50682	-0.12680	0.03106	0.90570	3.01948	2.48326	0.09457	1.01140	0.00070	0.00157	0.00440

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.200 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.20554	6.48976	-0.01599	0.02465	0.09991	5.74619	1.83394	0.02683	0.99996	-0.00000	0.03015	-0.00895
0.10	0.22813	6.34254	-0.05176	0.02523	0.32351	5.02615	1.96210	0.03048	0.00005	-0.06549	0.02626	0.05903
0.20	0.22814	6.34252	-0.05176	0.02523	0.32352	5.02612	1.96211	0.03048	0.00000	-0.06549	0.02626	0.05903
0.20	0.22832	6.47845	-0.03197	0.02470	0.19980	5.24992	1.88504	0.04492	1.00000	0.00000	0.01893	-0.00315
0.30	0.22814	6.34252	-0.05176	0.02523	0.32352	5.02610	1.96211	0.03048	0.00006	-0.06549	0.02626	0.05903
0.30	0.24037	6.43319	-0.04795	0.02487	0.29970	4.91284	1.93614	0.05429	0.99992	-0.00001	0.01366	-0.00029
0.40	0.22814	6.34252	-0.05176	0.02523	0.32352	5.02609	1.96211	0.03048	0.00004	-0.06549	0.02626	0.05903
0.40	0.24999	6.34020	-0.06393	0.02524	0.39959	4.62088	1.99599	0.06113	0.99996	-0.00000	0.01034	0.00158
0.50	0.22814	6.34252	-0.05176	0.02523	0.32352	5.02609	1.96211	0.03048	0.00002	-0.06549	0.02626	0.05903
0.50	0.25829	6.12761	-0.07992	0.02611	0.49948	4.29720	2.06684	0.06771	0.99996	-0.00000	0.00792	0.00289
0.60	0.22814	6.34252	-0.05176	0.02523	0.32353	5.02609	1.96211	0.03048	0.00002	-0.06549	0.02626	0.05903
0.60	0.26862	5.97492	-0.09590	0.02678	0.59940	3.97339	2.16306	0.07587	0.99999	-0.00000	0.00496	0.00442
0.70	0.22814	6.34252	-0.05176	0.02523	0.32352	5.02609	1.96211	0.03048	0.00001	-0.06549	0.02626	0.05903
0.70	0.27580	5.76205	-0.11189	0.02777	0.69931	3.68143	2.25599	0.08159	1.00001	0.00000	0.00357	0.00509
0.80	0.22814	6.34251	-0.05176	0.02523	0.32352	5.02609	1.96212	0.03048	0.00001	-0.06549	0.02626	0.05903
0.80	0.28305	5.44266	-0.12780	0.02940	0.79875	3.34365	2.38694	0.08773	0.99906	-0.00007	0.00269	0.00542
0.90	0.22814	6.34251	-0.05176	0.02523	0.32353	5.02609	1.96212	0.03048	0.00001	-0.06549	0.02626	0.05903
0.90	0.29257	4.90905	-0.14310	0.03259	0.89438	2.86349	2.60054	0.09608	0.99184	-0.00058	0.00221	0.00570

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.200 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
CL= 0.08												
0.10	0.22558	2.39212	-0.00799	0.03344	0.09993	6.45407	2.38592	0.07261	0.99986	-0.00000	0.01043	-0.00289
0.10	0.23420	2.34624	-0.02564	0.03410	0.32055	6.10038	2.46953	0.07475	0.00008	-0.03508	0.00987	0.03265
0.20	0.23420	2.34622	-0.02565	0.03410	0.32057	6.10032	2.46955	0.07475	0.00000	-0.03508	0.00987	0.03266
0.20	0.23428	2.37783	-0.01598	0.03364	0.19980	6.20595	2.42128	0.08295	1.00000	0.00000	0.00683	-0.00102
0.30	0.23421	2.34622	-0.02564	0.03410	0.32056	6.10021	2.46955	0.07476	0.00018	-0.03507	0.00987	0.03265
0.30	0.23913	2.36121	-0.02398	0.03388	0.29970	6.03742	2.45515	0.08823	0.99975	-0.00001	0.00515	-0.00009
0.40	0.23421	2.34623	-0.02565	0.03410	0.32058	6.10030	2.46955	0.07476	0.00013	-0.03508	0.00987	0.03265
0.40	0.24269	2.33892	-0.03197	0.03420	0.39958	5.89145	2.49311	0.09204	0.99988	-0.00000	0.00409	0.00052
0.50	0.23421	2.34622	-0.02565	0.03410	0.32058	6.10029	2.46956	0.07476	0.00009	-0.03508	0.00987	0.03265
0.50	0.24597	2.29971	-0.03996	0.03479	0.49947	5.72962	2.54782	0.09563	0.99992	-0.00000	0.00331	0.00097
0.60	0.23421	2.34622	-0.02565	0.03410	0.32058	6.10030	2.46955	0.07476	0.00007	-0.03503	0.00987	0.03266
0.60	0.24997	2.27145	-0.04795	0.03522	0.59939	5.56772	2.59276	0.10001	0.99996	-0.00000	0.00224	0.00157
0.70	0.23421	2.34623	-0.02565	0.03410	0.32059	6.10030	2.46955	0.07476	0.00007	-0.03508	0.00987	0.03266
0.70	0.25278	2.23480	-0.05594	0.03580	0.69928	5.42163	2.64564	0.10301	0.99992	-0.00000	0.00172	0.00188
0.80	0.23421	2.34622	-0.02565	0.03410	0.32059	6.10028	2.46956	0.07476	0.00005	-0.03508	0.00987	0.03266
0.80	0.25561	2.18209	-0.06393	0.03666	0.79911	5.25375	2.71692	0.10619	0.99982	-0.00001	0.00136	0.00210
0.90	0.23421	2.34623	-0.02565	0.03410	0.32060	6.10029	2.46956	0.07476	0.00005	-0.03508	0.00987	0.03265
0.90	0.25915	2.09146	-0.07190	0.03825	0.89873	5.01132	2.83665	0.11064	0.99937	-0.00002	0.00109	0.00222
CL= 0.10												
0.10	0.21820	2.98279	-0.00999	0.03353	0.09993	6.63521	2.40357	0.06567	0.99988	-0.00001	0.01291	-0.00357
0.10	0.22898	2.90861	-0.03204	0.03438	0.32039	6.19351	2.50970	0.06822	0.00006	-0.04402	0.01210	0.04105
0.20	0.22898	2.90858	-0.03204	0.03438	0.32040	6.19344	2.50972	0.06822	0.00000	-0.04402	0.01210	0.04105
0.20	0.22908	2.95937	-0.01998	0.03379	0.19980	6.32505	2.44839	0.07859	1.00000	0.00000	0.00842	-0.00126
0.30	0.22898	2.90859	-0.03204	0.03438	0.32040	6.19344	2.50972	0.06822	0.00015	-0.04402	0.01210	0.04104
0.30	0.23514	2.93215	-0.02997	0.03410	0.29970	6.11439	2.49149	0.08520	0.99981	-0.00001	0.00633	-0.00012
0.40	0.22898	2.90858	-0.03204	0.03438	0.32041	6.19342	2.50972	0.06822	0.00008	-0.04402	0.01210	0.04105
0.40	0.23960	2.89586	-0.03996	0.03453	0.39959	5.93192	2.54000	0.08996	0.99990	-0.00000	0.00501	0.00062
0.50	0.22898	2.90858	-0.03204	0.03438	0.32041	6.19342	2.50972	0.06822	0.00007	-0.04402	0.01210	0.04105
0.50	0.24373	2.83297	-0.04995	0.03530	0.49948	5.72962	2.61015	0.09444	0.99994	-0.00000	0.00405	0.00116
0.60	0.22898	2.90859	-0.03204	0.03438	0.32042	6.19343	2.50972	0.06822	0.00006	-0.04402	0.01210	0.04105
0.60	0.24875	2.78722	-0.05994	0.03588	0.59940	5.52724	2.66810	0.09993	0.99998	-0.00000	0.00275	0.00186
0.70	0.22898	2.90860	-0.03204	0.03438	0.32042	6.19343	2.50971	0.06822	0.00007	-0.04402	0.01210	0.04105
0.70	0.25229	2.72878	-0.06993	0.03665	0.69934	5.34472	2.73651	0.10370	1.00010	0.00000	0.00212	0.00221
0.80	0.22898	2.90858	-0.03204	0.03438	0.32042	6.19342	2.50973	0.06822	0.00004	-0.04402	0.01210	0.04105
0.80	0.25587	2.64620	-0.07992	0.03779	0.79920	5.13532	2.82830	0.10767	1.00000	0.00000	0.00169	0.00243
0.90	0.22898	2.90858	-0.03204	0.03438	0.32042	6.19342	2.50972	0.06822	0.00004	-0.04402	0.01210	0.04105
0.90	0.26059	2.50457	-0.08995	0.03993	0.89952	4.82647	2.98624	0.11329	1.00072	0.00003	0.00136	0.00247

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.200 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.12

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.21081	3.57007	-0.01199	0.03361	0.09992	6.81634	2.42143	0.05869	0.99990	-0.00001	0.01534	-0.00424
0.10	0.22376	3.45986	-0.03843	0.03468	0.32022	6.28680	2.55071	0.06160	0.00005	-0.05303	0.01424	0.04953
0.20	0.22376	3.45982	-0.03843	0.03468	0.32024	6.28673	2.55074	0.06160	0.00000	-0.05303	0.01424	0.04953
0.20	0.22368	3.53481	-0.02398	0.03395	0.19980	6.44414	2.47595	0.07419	1.00000	0.00000	0.00997	-0.00145
0.30	0.22376	3.45982	-0.03843	0.03468	0.32023	6.28672	2.55073	0.06160	0.00012	-0.05302	0.01424	0.04952
0.30	0.23117	3.49388	-0.03596	0.03435	0.29970	6.19134	2.52860	0.08213	0.99987	-0.00001	0.00747	-0.00014
0.40	0.22376	3.45982	-0.03843	0.03468	0.32024	6.28672	2.55074	0.06160	0.00006	-0.05303	0.01424	0.04953
0.40	0.23653	3.43971	-0.04795	0.03489	0.39959	5.97237	2.58808	0.08784	0.99992	-0.00000	0.00590	0.00072
0.50	0.22376	3.45982	-0.03843	0.03468	0.32025	6.28671	2.55074	0.06160	0.00006	-0.05303	0.01424	0.04953
0.50	0.24151	3.34718	-0.05994	0.03585	0.49948	5.72962	2.67437	0.09321	0.99995	-0.00000	0.00475	0.00133
0.60	0.22376	3.45983	-0.03843	0.03468	0.32025	6.28672	2.55073	0.06160	0.00005	-0.05303	0.01424	0.04953
0.60	0.24755	3.27945	-0.07193	0.03659	0.59939	5.48677	2.74605	0.09982	0.99996	-0.00000	0.00323	0.00212
0.70	0.22376	3.45982	-0.03843	0.03468	0.32025	6.28670	2.55074	0.06160	0.00003	-0.05303	0.01424	0.04953
0.70	0.25183	3.19379	-0.08391	0.02757	0.69924	5.26768	2.83091	0.10434	0.99983	-0.00001	0.00251	0.00250
0.80	0.22376	3.45982	-0.03843	0.03468	0.32025	6.28671	2.55074	0.06160	0.00003	-0.05303	0.01424	0.04953
0.80	0.25618	3.07449	-0.09591	0.03903	0.79928	5.01560	2.94612	0.10914	1.00018	0.00001	0.00201	0.00270
0.90	0.22376	3.45984	-0.03843	0.03468	0.32026	6.28671	2.55073	0.06160	0.00004	-0.05303	0.01424	0.04953
0.90	0.26205	2.88523	-0.10849	0.04159	0.90406	4.64901	3.14314	0.11597	1.00854	0.00047	0.00156	0.00230

CL= 0.14

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.20343	4.15374	-0.01399	0.03370	0.09992	6.99747	2.43949	0.05167	0.99992	-0.00000	0.01773	-0.00489
0.10	0.21854	3.99939	-0.04481	0.03501	0.32007	6.38025	2.59256	0.05489	0.00003	-0.06210	0.01630	0.05809
0.20	0.21854	3.99934	-0.04481	0.03501	0.32008	6.38018	2.59260	0.05489	0.00000	-0.06210	0.01630	0.05809
0.20	0.21868	4.10373	-0.02797	0.03412	0.19980	6.56323	2.50396	0.06976	1.00000	0.00000	0.01147	-0.00170
0.30	0.21854	3.99935	-0.04481	0.03501	0.32007	6.38017	2.59259	0.05489	0.00010	-0.06209	0.01630	0.05809
0.30	0.22720	4.04580	-0.04196	0.03460	0.29970	6.26830	2.56648	0.07902	0.99988	-0.00001	0.00857	-0.00016
0.40	0.21854	3.99934	-0.04481	0.03501	0.32008	6.38017	2.59260	0.05489	0.00006	-0.06209	0.01630	0.05809
0.40	0.23347	3.96967	-0.05594	0.03527	0.39959	6.01283	2.63735	0.08568	0.99993	-0.00000	0.00675	0.00081
0.50	0.21854	3.99935	-0.04481	0.03501	0.32009	6.38017	2.59259	0.05489	0.00005	-0.06209	0.01630	0.05809
0.50	0.23931	3.84153	-0.06993	0.03644	0.49948	5.72962	2.74048	0.09194	0.99996	-0.00000	0.00542	0.00148
0.60	0.21854	3.99936	-0.04481	0.03501	0.32009	6.38017	2.59259	0.05489	0.00005	-0.06209	0.01630	0.05809
0.60	0.24638	3.74737	-0.08391	0.03736	0.59939	5.44626	2.82664	0.09968	0.99995	-0.00000	0.00369	0.00236
0.70	0.21854	3.99934	-0.04481	0.03501	0.32009	6.38015	2.59260	0.05489	0.00003	-0.06210	0.01630	0.05809
0.70	0.25140	3.62987	-0.09790	0.03857	0.69926	5.19063	2.92892	0.10497	0.99988	-0.00001	0.00288	0.00275
0.80	0.21854	3.99934	-0.04481	0.03501	0.32009	6.38016	2.59260	0.05489	0.00004	-0.06210	0.01630	0.05809
0.80	0.25652	3.46762	-0.11181	0.04037	0.79868	4.89623	3.06851	0.11053	0.99892	-0.00007	0.00233	0.00300
0.90	0.21854	3.99936	-0.04481	0.03501	0.32010	6.38017	2.59259	0.05489	0.00004	-0.06209	0.01630	0.05809
0.90	0.26324	3.19668	-0.12520	0.04380	0.89430	4.46175	3.30833	0.11824	0.99174	-0.00054	0.00197	0.00340

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.200 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.19606	4.73360	-0.01599	0.03380	0.09991	7.17861	2.45775	0.04462	0.99993	-0.00000	0.02007	-0.00553
0.10	0.21333	4.52658	-0.05119	0.03535	0.31992	6.47386	2.63527	0.04810	0.00001	-0.07123	0.01827	0.06674
0.20	0.21333	4.52661	-0.05119	0.03535	0.31992	6.47381	2.63530	0.04810	0.00000	-0.07123	0.01827	0.06674
0.20	0.21349	4.66572	-0.03197	0.03429	0.19980	6.68232	2.53242	0.06529	1.00000	0.00000	0.01293	-0.00191
0.30	0.21333	4.52662	-0.05119	0.03535	0.31992	6.47378	2.63530	0.04810	0.00009	-0.07122	0.01827	0.06673
0.30	0.22324	4.58730	-0.04795	0.03488	0.29970	6.34525	2.60513	0.07588	0.99988	-0.00001	0.00963	-0.00019
0.40	0.21333	4.52661	-0.05119	0.03535	0.31992	6.47379	2.63530	0.04810	0.00006	-0.07122	0.01827	0.06673
0.40	0.23043	4.48506	-0.06393	0.03567	0.39959	6.05329	2.68781	0.08349	0.99994	-0.00000	0.00756	0.00089
0.50	0.21333	4.52662	-0.05119	0.03535	0.31993	6.47378	2.63530	0.04810	0.00005	-0.07122	0.01827	0.06673
0.50	0.23712	4.31543	-0.07992	0.03708	0.49948	5.72962	2.80851	0.09064	0.99997	-0.00000	0.00605	0.00162
0.60	0.21333	4.52663	-0.05119	0.03535	0.31993	6.47379	2.63530	0.04810	0.00005	-0.07122	0.01827	0.06673
0.60	0.24523	4.19058	-0.09590	0.03818	0.59939	5.40578	2.90984	0.09951	0.99995	-0.00000	0.00413	0.00256
0.70	0.21333	4.52661	-0.05119	0.03535	0.31993	6.47377	2.63531	0.04810	0.00003	-0.07123	0.01827	0.06674
0.70	0.25101	4.03697	-0.11188	0.03963	0.69925	5.11385	3.03032	0.10557	0.99985	-0.00001	0.00323	0.00296
0.80	0.21333	4.52661	-0.05119	0.03535	0.31993	6.47378	2.63531	0.04810	0.00003	-0.07123	0.01827	0.06674
0.80	0.25691	3.82889	-0.12784	0.04179	0.79899	4.77764	3.19550	0.11194	0.99956	-0.00003	0.00261	0.00316
0.90	0.21333	4.52662	-0.05119	0.03535	0.31994	6.47378	2.63530	0.04810	0.00003	-0.07123	0.01827	0.06673
0.90	0.26472	3.49725	-0.14352	0.04575	0.89698	4.28671	3.47812	0.12070	0.99636	-0.00027	0.00218	0.00329

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.13966	17.45026	-0.00799	0.00458	0.09990	3.73421	0.00603	0.99999	-0.00000
0.10	0.14515	16.80508	-0.01224	0.00476	0.15305	3.63335	0.00633	0.75000	-0.00102
0.10	0.15064	16.19510	-0.01650	0.00494	0.20620	3.53249	0.00662	0.50000	-0.00204
0.10	0.15613	15.61772	-0.02075	0.00512	0.25935	3.43162	0.00691	0.25001	-0.00306
0.10	0.16161	15.07063	-0.02500	0.00531	0.31250	3.33076	0.00720	0.00001	-0.00407
0.20	0.16161	15.07102	-0.02500	0.00531	0.31246	3.33079	0.00721	0.00036	-0.00407
0.20	0.16165	15.35533	-0.02275	0.00521	0.28435	3.35715	0.01091	0.24975	-0.00306
0.20	0.16168	15.64735	-0.02050	0.00511	0.25624	3.38351	0.01461	0.49923	-0.00204
0.20	0.16172	15.94882	-0.01825	0.00502	0.22812	3.40988	0.01830	0.74871	-0.00102
0.20	0.16175	16.25946	-0.01599	0.00492	0.19992	3.43632	0.02201	0.99891	-0.00000
0.30	0.16161	15.07063	-0.02500	0.00531	0.31250	3.33076	0.00720	0.00000	-0.00407
0.30	0.16483	15.12280	-0.02474	0.00529	0.30930	3.30661	0.01291	0.24999	-0.00306
0.30	0.16805	15.17527	-0.02449	0.00527	0.30610	3.28247	0.01861	0.49999	-0.00204
0.30	0.17126	15.22796	-0.02423	0.00525	0.30290	3.25833	0.02432	0.74998	-0.00102
0.30	0.17448	15.28099	-0.02398	0.00524	0.29969	3.23418	0.03002	0.99999	-0.00000
0.40	0.16161	15.07063	-0.02500	0.00531	0.31250	3.33075	0.00720	0.00000	-0.00407
0.40	0.16726	14.88140	-0.02674	0.00538	0.33427	3.26282	0.01431	0.25000	-0.00306
0.40	0.17290	14.69574	-0.02848	0.00544	0.35605	3.19488	0.02141	0.49999	-0.00204
0.40	0.17855	14.51349	-0.03023	0.00551	0.37782	3.12694	0.02851	0.74999	-0.00102
0.40	0.18419	14.33465	-0.03197	0.00558	0.39959	3.05900	0.03561	0.99999	-0.00000
0.50	0.16161	15.07063	-0.02500	0.00531	0.31250	3.33075	0.00720	0.00000	-0.00407
0.50	0.16962	14.56678	-0.02874	0.00549	0.35925	3.21426	0.01557	0.25000	-0.00306
0.50	0.17763	14.08779	-0.03248	0.00568	0.40599	3.09777	0.02393	0.50000	-0.00204
0.50	0.18564	13.63203	-0.03622	0.00587	0.45274	2.98128	0.03229	0.74999	-0.00102
0.50	0.19365	13.19805	-0.03996	0.00606	0.49949	2.86478	0.04066	0.99999	-0.00000
0.60	0.16161	15.07062	-0.02500	0.00531	0.31250	3.33075	0.00720	0.00000	-0.00407
0.60	0.17234	14.31219	-0.03074	0.00559	0.38423	3.16569	0.01714	0.25000	-0.00306
0.60	0.18306	13.60962	-0.03648	0.00588	0.45595	3.00063	0.02709	0.50000	-0.00204
0.60	0.19378	12.95754	-0.04221	0.00617	0.52768	2.83556	0.03703	0.75000	-0.00102
0.60	0.20450	12.35121	-0.04795	0.00648	0.59940	2.67050	0.04697	1.00000	-0.00000
0.70	0.16161	15.07062	-0.02500	0.00531	0.31250	3.33075	0.00720	0.00000	-0.00407
0.70	0.17437	14.03584	-0.03274	0.00570	0.40920	3.12189	0.01817	0.25000	-0.00306
0.70	0.18713	13.10409	-0.04047	0.00610	0.50590	2.91303	0.02914	0.50000	-0.00204
0.70	0.19989	12.26212	-0.04821	0.00652	0.60260	2.70417	0.04010	0.74999	-0.00102
0.70	0.21265	11.49876	-0.05594	0.00696	0.69931	2.49531	0.05107	1.00000	-0.00000
0.80	0.16161	15.07062	-0.02500	0.00531	0.31250	3.33075	0.00720	0.00000	-0.00407
0.80	0.17652	13.69224	-0.03473	0.00584	0.43417	3.07140	0.01922	0.25000	-0.00306
0.80	0.19143	12.49469	-0.04447	0.00640	0.55585	2.81205	0.03123	0.50000	-0.00204
0.80	0.20634	11.44761	-0.05420	0.00699	0.67752	2.55270	0.04324	0.75000	-0.00102
0.80	0.22125	10.52687	-0.06394	0.00760	0.79919	2.29334	0.05525	1.00000	-0.00000
0.90	0.16161	15.07063	-0.02500	0.00531	0.31250	3.33075	0.00720	0.00000	-0.00407
0.90	0.17946	13.17092	-0.03673	0.00607	0.45915	2.99735	0.02064	0.25000	-0.00306
0.90	0.19730	11.60903	-0.04846	0.00689	0.60580	2.66393	0.03408	0.50000	-0.00204
0.90	0.21515	10.30933	-0.06020	0.00776	0.75245	2.33052	0.04751	0.75000	-0.00102
0.90	0.23299	9.21629	-0.07193	0.00868	0.89910	1.99711	0.06095	1.00000	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.30	0.13518	23.64156	-0.04840	0.00677	0.30251	3.64610	0.00000	0.77985	-0.00359
0.30	0.13660	23.67345	-0.04829	0.00676	0.30181	3.63547	0.00251	0.83489	-0.00269
0.30	0.13801	23.70540	-0.04818	0.00675	0.30110	3.62484	0.00502	0.88992	-0.00179
0.30	0.13943	23.73737	-0.04806	0.00674	0.30040	3.61421	0.00754	0.94496	-0.00090
0.30	0.14085	23.76945	-0.04795	0.00673	0.29969	3.60358	0.01005	1.00000	-0.00000
0.40	0.14341	21.95621	-0.05873	0.00729	0.36706	3.45622	0.00000	0.62647	-0.00609
0.40	0.14762	21.77985	-0.06003	0.00735	0.37519	3.40547	0.00531	0.71985	-0.00457
0.40	0.15184	21.60558	-0.06133	0.00741	0.38333	3.35472	0.01061	0.81323	-0.00304
0.40	0.15606	21.43346	-0.06263	0.00746	0.39146	3.30396	0.01592	0.90661	-0.00152
0.40	0.16027	21.26332	-0.06393	0.00752	0.39959	3.25320	0.02122	1.00000	-0.00000
0.50	0.14920	20.48944	-0.06592	0.00781	0.41197	3.30096	0.00000	0.53197	-0.00763
0.50	0.15670	19.95772	-0.06942	0.00802	0.43385	3.19191	0.00783	0.64897	-0.00572
0.50	0.16420	19.44644	-0.07292	0.00823	0.45573	3.08286	0.01566	0.76598	-0.00381
0.50	0.17170	18.95454	-0.07642	0.00844	0.47761	2.97382	0.02349	0.88299	-0.00191
0.50	0.17920	18.48106	-0.07992	0.00866	0.49949	2.86477	0.03132	1.00000	-0.00000
0.60	0.15351	19.80875	-0.07054	0.00808	0.44090	3.20573	0.00000	0.44754	-0.00900
0.60	0.16535	18.91226	-0.07688	0.00846	0.48052	3.02335	0.01098	0.58565	-0.00675
0.60	0.17720	18.07529	-0.08322	0.00885	0.52015	2.84097	0.02197	0.72377	-0.00450
0.60	0.18905	17.29268	-0.08956	0.00925	0.55977	2.65858	0.03295	0.86188	-0.00225
0.60	0.20090	16.55980	-0.09590	0.00965	0.59940	2.47620	0.04394	1.00000	-0.00000
0.70	0.15653	19.06374	-0.07511	0.00839	0.46942	3.11886	0.00000	0.40569	-0.00969
0.70	0.17169	17.82285	-0.08430	0.00898	0.52689	2.87060	0.01304	0.55427	-0.00726
0.70	0.18686	16.69930	-0.09350	0.00958	0.58436	2.62234	0.02607	0.70284	-0.00484
0.70	0.20203	15.67874	-0.10269	0.01020	0.64183	2.37409	0.03911	0.85142	-0.00242
0.70	0.21719	14.74895	-0.11189	0.01085	0.69930	2.12583	0.05214	1.00000	-0.00000
0.80	0.15929	18.24063	-0.07884	0.00877	0.49276	3.02824	0.00000	0.37038	-0.01026
0.80	0.17807	16.60405	-0.09110	0.00964	0.56937	2.70166	0.01513	0.52779	-0.00770
0.80	0.19684	15.17824	-0.10336	0.01054	0.64598	2.37507	0.03025	0.68519	-0.00513
0.80	0.21562	13.92849	-0.11561	0.01149	0.72259	2.04849	0.04538	0.84259	-0.00257
0.80	0.23439	12.82697	-0.12787	0.01247	0.79920	1.72190	0.06051	1.00000	-0.00000
0.90	0.16238	17.18114	-0.08108	0.00931	0.50674	2.91350	0.00000	0.33113	-0.01090
0.90	0.18625	14.99589	-0.09677	0.01067	0.60483	2.46748	0.01797	0.49835	-0.00818
0.90	0.21012	13.20249	-0.11247	0.01212	0.70292	2.02147	0.03595	0.66556	-0.00545
0.90	0.23399	11.71258	-0.12816	0.01366	0.80101	1.57545	0.05392	0.83278	-0.00273
0.90	0.25786	10.46136	-0.14386	0.01529	0.89910	1.12943	0.07190	1.00000	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.17389	4.70658	-0.00799	0.01700	0.09990	6.59900	0.05603	1.00000	-0.00000
0.10	0.17563	4.61499	-0.01224	0.01733	0.15305	6.49814	0.05633	0.75000	-0.00102
0.10	0.17938	4.52605	-0.01650	0.01768	0.20620	6.39727	0.05662	0.50001	-0.00204
0.10	0.18212	4.43965	-0.02075	0.01802	0.25935	6.29642	0.05691	0.25002	-0.00306
0.10	0.18486	4.35569	-0.02500	0.01837	0.31250	6.19555	0.05720	0.00001	-0.00407
0.20	0.18486	4.35587	-0.02499	0.01837	0.31239	6.19565	0.05722	0.00100	-0.00407
0.20	0.18488	4.39964	-0.02275	0.01818	0.28435	6.22194	0.06091	0.24975	-0.00306
0.20	0.18490	4.44406	-0.02051	0.01800	0.25633	6.24821	0.06459	0.49842	-0.00204
0.20	0.18491	4.48918	-0.01826	0.01782	0.22829	6.27450	0.06828	0.74717	-0.00103
0.20	0.18493	4.53552	-0.01599	0.01764	0.19993	6.30110	0.07201	0.99882	-0.00000
0.30	0.18486	4.35569	-0.02500	0.01837	0.31250	6.19554	0.05720	0.00001	-0.00407
0.30	0.18647	4.36379	-0.02474	0.01833	0.30930	6.17140	0.06291	0.25000	-0.00306
0.30	0.18808	4.37191	-0.02449	0.01830	0.30610	6.14725	0.06861	0.49999	-0.00204
0.30	0.18969	4.38006	-0.02423	0.01826	0.30290	6.12311	0.07432	0.74998	-0.00102
0.30	0.19130	4.38822	-0.02398	0.01823	0.29969	6.09897	0.08002	0.99998	-0.00000
0.40	0.18486	4.35569	-0.02500	0.01837	0.31250	6.19554	0.05720	0.00001	-0.00407
0.40	0.18769	4.32616	-0.02674	0.01849	0.33427	6.12761	0.06431	0.25000	-0.00306
0.40	0.19051	4.29694	-0.02848	0.01862	0.35605	6.05966	0.07141	0.49999	-0.00204
0.40	0.19333	4.26800	-0.03023	0.01874	0.37782	5.99173	0.07851	0.74999	-0.00102
0.40	0.19615	4.23936	-0.03197	0.01887	0.39959	5.92379	0.08561	0.99999	-0.00000
0.50	0.18486	4.35569	-0.02500	0.01837	0.31250	6.19554	0.05720	0.00000	-0.00407
0.50	0.18887	4.27649	-0.02874	0.01871	0.35925	6.07904	0.06557	0.25000	-0.00306
0.50	0.19287	4.19942	-0.03248	0.01905	0.40599	5.96255	0.07393	0.50000	-0.00204
0.50	0.19688	4.12441	-0.03622	0.01940	0.45274	5.84606	0.08229	0.74999	-0.00102
0.50	0.20088	4.05141	-0.03996	0.01975	0.49949	5.72958	0.09066	0.99999	-0.00000
0.60	0.18486	4.35569	-0.02500	0.01837	0.31250	6.19554	0.05720	0.00000	-0.00407
0.60	0.19023	4.23574	-0.03074	0.01889	0.38423	6.03048	0.06714	0.25000	-0.00306
0.60	0.19559	4.12068	-0.03648	0.01941	0.45595	5.86541	0.07709	0.49999	-0.00204
0.60	0.20095	4.01025	-0.04221	0.01995	0.52767	5.70035	0.08703	0.74999	-0.00102
0.60	0.20631	3.90419	-0.04795	0.02049	0.59940	5.53528	0.09697	0.99999	-0.00000
0.70	0.18486	4.35569	-0.02500	0.01837	0.31250	6.19554	0.05720	0.00000	-0.00407
0.70	0.19124	4.19095	-0.03274	0.01909	0.40920	5.98668	0.06817	0.25000	-0.00306
0.70	0.19762	4.03539	-0.04047	0.01982	0.50590	5.77782	0.07914	0.49999	-0.00204
0.70	0.20400	3.88832	-0.04821	0.02057	0.60260	5.56897	0.09010	0.74999	-0.00102
0.70	0.21038	3.74915	-0.05594	0.02134	0.69930	5.36010	0.10107	0.99999	-0.00000
0.80	0.18486	4.35569	-0.02500	0.01837	0.31250	6.19554	0.05720	0.00000	-0.00407
0.80	0.19232	4.13442	-0.03473	0.01935	0.43417	5.93619	0.06922	0.25000	-0.00306
0.80	0.19977	3.92959	-0.04447	0.02036	0.55585	5.67684	0.08123	0.50000	-0.00204
0.80	0.20723	3.73961	-0.05420	0.02139	0.67752	5.41749	0.09324	0.75000	-0.00102
0.80	0.21468	3.56309	-0.06394	0.02245	0.79919	5.15814	0.10525	0.99999	-0.00000
0.90	0.18486	4.35569	-0.02500	0.01837	0.31250	6.19554	0.05720	0.00000	-0.00407
0.90	0.19379	4.04679	-0.03673	0.01977	0.45915	5.86213	0.07064	0.25000	-0.00306
0.90	0.20271	3.76962	-0.04846	0.02122	0.60580	5.52873	0.08408	0.50000	-0.00204
0.90	0.21163	3.51997	-0.06020	0.02273	0.75245	5.19531	0.09751	0.74999	-0.00102
0.90	0.22055	3.29433	-0.07193	0.02428	0.89910	4.86190	0.11095	0.99999	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.13966	8.72512	-0.01598	0.01834	0.09990	7.46842	0.01207	1.00000	-0.00000
0.10	0.14515	8.40254	-0.02449	0.01904	0.15305	7.26669	0.01265	0.75000	-0.00407
0.10	0.15064	8.09753	-0.03299	0.01976	0.20620	7.06497	0.01324	0.50000	-0.00815
0.10	0.15613	7.80884	-0.04150	0.02049	0.25935	6.86324	0.01382	0.25000	-0.01222
0.10	0.16161	7.53531	-0.05000	0.02123	0.31250	6.66151	0.01441	0.00001	-0.01630
0.20	0.16161	7.53546	-0.05000	0.02123	0.31247	6.66156	0.01441	0.00027	-0.01629
0.20	0.16165	7.67766	-0.04550	0.02084	0.28435	6.71429	0.02181	0.24975	-0.01223
0.20	0.16168	7.82429	-0.04099	0.02045	0.25616	6.76716	0.02923	0.49986	-0.00815
0.20	0.16172	7.97478	-0.03649	0.02006	0.22805	6.81989	0.03663	0.74934	-0.00409
0.20	0.16175	8.12966	-0.03199	0.01968	0.19993	6.87262	0.04403	0.99882	-0.00002
0.30	0.16161	7.53530	-0.05000	0.02123	0.31250	6.66151	0.01441	0.00000	-0.01630
0.30	0.16483	7.56140	-0.04949	0.02116	0.30930	6.61322	0.02582	0.25000	-0.01222
0.30	0.16805	7.58762	-0.04898	0.02109	0.30610	6.56494	0.03723	0.49999	-0.00815
0.30	0.17126	7.61398	-0.04846	0.02101	0.30290	6.51666	0.04864	0.74999	-0.00407
0.30	0.17448	7.64048	-0.04795	0.02094	0.29969	6.46837	0.06005	0.99999	-0.00000
0.40	0.16161	7.53530	-0.05000	0.02123	0.31250	6.66151	0.01441	0.00000	-0.01630
0.40	0.16726	7.44069	-0.05348	0.02150	0.33427	6.52562	0.02861	0.25000	-0.01222
0.40	0.17290	7.34786	-0.05697	0.02178	0.35605	6.38976	0.04281	0.50000	-0.00815
0.40	0.17855	7.25674	-0.06045	0.02205	0.37782	6.25388	0.05702	0.74999	-0.00407
0.40	0.18419	7.16732	-0.06393	0.02232	0.39959	6.11800	0.07122	0.99999	-0.00000
0.50	0.16161	7.53530	-0.05000	0.02123	0.31250	6.66151	0.01441	0.00000	-0.01630
0.50	0.16962	7.28338	-0.05748	0.02197	0.35925	6.42852	0.03113	0.25000	-0.01222
0.50	0.17763	7.04388	-0.06496	0.02271	0.40599	6.19554	0.04786	0.50000	-0.00815
0.50	0.18564	6.81602	-0.07244	0.02347	0.45274	5.96255	0.06459	0.74999	-0.00407
0.50	0.19365	6.59902	-0.07992	0.02425	0.49949	5.72956	0.08132	1.00000	-0.00000
0.60	0.16161	7.53530	-0.05000	0.02123	0.31250	6.66151	0.01441	0.00000	-0.01630
0.60	0.17234	7.15610	-0.06148	0.02236	0.38422	6.33138	0.03429	0.25000	-0.01222
0.60	0.18306	6.80480	-0.07295	0.02351	0.45595	6.00125	0.05417	0.50000	-0.00815
0.60	0.19378	6.47876	-0.08443	0.02470	0.52767	5.67112	0.07406	0.75000	-0.00407
0.60	0.20450	6.17560	-0.09590	0.02591	0.59940	5.34098	0.09394	1.00000	-0.00000
0.70	0.16161	7.53530	-0.05000	0.02123	0.31250	6.66151	0.01441	0.00000	-0.01630
0.70	0.17437	7.01790	-0.06547	0.02280	0.40920	6.24378	0.03634	0.25000	-0.01222
0.70	0.18713	6.55203	-0.08094	0.02442	0.50590	5.82606	0.05827	0.50000	-0.00815
0.70	0.19989	6.13105	-0.09642	0.02610	0.60260	5.40835	0.08021	0.75000	-0.00407
0.70	0.21265	5.74938	-0.11189	0.02783	0.69930	4.99061	0.10214	1.00000	-0.00000
0.80	0.16161	7.53531	-0.05000	0.02123	0.31250	6.66151	0.01441	0.00000	-0.01630
0.80	0.17652	6.84612	-0.06947	0.02337	0.43417	6.14280	0.03843	0.25000	-0.01222
0.80	0.19143	6.24734	-0.08894	0.02561	0.55585	5.62410	0.06246	0.50000	-0.00815
0.80	0.20634	5.72380	-0.10840	0.02795	0.67752	5.10540	0.08648	0.75000	-0.00407
0.80	0.22125	5.26343	-0.12787	0.03040	0.79919	4.58669	0.11051	1.00000	-0.00000
0.90	0.16161	7.53530	-0.05000	0.02123	0.31250	6.66151	0.01441	0.00000	-0.01630
0.90	0.17946	6.58545	-0.07346	0.02430	0.45915	5.99468	0.04128	0.25000	-0.01222
0.90	0.19730	5.80451	-0.09693	0.02756	0.60580	5.32786	0.06815	0.50000	-0.00815
0.90	0.21515	5.15466	-0.12039	0.03104	0.75245	4.66104	0.09503	0.75000	-0.00407
0.90	0.23299	4.60814	-0.14386	0.03472	0.89910	3.99423	0.12190	1.00000	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.100 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.19630	9.78810	-0.00799	0.00817	0.09990	3.65517	2.28544	0.02063	1.00000	-0.00000	0.01204	-0.00337
0.10	0.20099	9.69406	-0.01241	0.00825	0.15518	3.55840	2.32627	0.02112	0.75023	-0.00941	0.01171	0.00624
0.10	0.20568	9.59494	-0.01683	0.00834	0.21040	3.46179	2.36805	0.02160	0.50029	-0.01892	0.01140	0.01593
0.10	0.21037	9.49127	-0.02124	0.00843	0.26554	3.36535	2.41076	0.02207	0.25022	-0.02852	0.01111	0.02570
0.10	0.21506	9.38351	-0.02565	0.00853	0.32063	3.26909	2.45442	0.02253	0.00000	-0.03821	0.01084	0.03555
0.20	0.21506	9.38357	-0.02565	0.00853	0.32060	3.26911	2.45440	0.02254	0.00026	-0.03820	0.01084	0.03554
0.30	0.21506	9.38347	-0.02565	0.00853	0.32063	3.26908	2.45443	0.02253	-0.00001	-0.03821	0.01084	0.03555
0.30	0.21774	9.41645	-0.02523	0.00850	0.31543	3.25193	2.44697	0.02622	0.24969	-0.02865	0.00957	0.02662
0.30	0.22043	9.44960	-0.02482	0.00847	0.31020	3.23478	2.43951	0.02990	0.49958	-0.01909	0.00829	0.01769
0.30	0.22311	9.48294	-0.02440	0.00844	0.30496	3.21768	2.43205	0.03357	0.74967	-0.00954	0.00700	0.00879
0.30	0.22579	9.51646	-0.02398	0.00841	0.29969	3.20060	2.42458	0.03724	0.99998	-0.00000	0.00570	-0.00011
0.40	0.21506	9.38348	-0.02565	0.00853	0.32063	3.26908	2.45443	0.02253	0.00000	-0.03821	0.01084	0.03555
0.40	0.21968	9.36605	-0.02723	0.00854	0.34036	3.21215	2.46653	0.02720	0.25039	-0.02868	0.00921	0.02684
0.40	0.22431	9.34804	-0.02881	0.00856	0.36010	3.15521	2.47873	0.03189	0.50052	-0.01913	0.00760	0.01810
0.40	0.22893	9.32945	-0.03039	0.00857	0.37985	3.09828	2.49103	0.03659	0.75039	-0.00957	0.00601	0.0093[illegible]
0.40	0.23356	9.31028	-0.03197	0.00859	0.39959	3.04134	2.50344	0.04130	0.99999	-0.00000	0.00444	0.0005[illegible]
0.50	0.21506	9.38347	-0.02565	0.00853	0.32063	3.26907	2.45443	0.02253	-0.00000	-0.03821	0.01084	0.03555
0.50	0.22148	9.27884	-0.02924	0.00862	0.36545	3.16777	2.49462	0.02811	0.25130	-0.02872	0.00889	0.02704
0.50	0.22791	9.17200	-0.03282	0.00872	0.41020	3.06661	2.53554	0.03374	0.50173	-0.01919	0.00702	0.01845
0.50	0.23433	9.06323	-0.03639	0.00883	0.45488	2.96562	2.57717	0.03941	0.75128	-0.00962	0.00523	0.00977
0.50	0.24075	8.95285	-0.03996	0.00894	0.49949	2.86478	2.61952	0.04514	0.99999	-0.00000	0.00352	0.00101
0.60	0.21506	9.38348	-0.02565	0.00853	0.32063	3.26908	2.45443	0.02253	0.00000	-0.03821	0.01084	0.03555
0.60	0.22368	9.21618	-0.03125	0.00868	0.39064	3.12323	2.51753	0.02924	0.25186	-0.02876	0.00850	0.02729
0.60	0.23229	9.04431	-0.03684	0.00885	0.46044	2.97779	2.58235	0.03604	0.50243	-0.01924	0.00631	0.01886
0.60	0.24090	8.86902	-0.04240	0.00902	0.53002	2.83277	2.64883	0.04293	0.75179	-0.00965	0.00427	0.01029
0.60	0.24952	8.69130	-0.04795	0.00920	0.59940	2.68815	2.71701	0.04989	0.99999	-0.00000	0.00237	0.00157
0.70	0.21506	9.38348	-0.02565	0.00853	0.32063	3.26908	2.45443	0.02253	0.00000	-0.03821	0.01084	0.03555
0.70	0.22523	9.13495	-0.03328	0.00876	0.41603	3.08270	2.54443	0.03000	0.25265	-0.02881	0.00825	0.02745
0.70	0.23540	8.98013	-0.04087	0.00901	0.51091	2.89720	2.63770	0.03760	0.50342	-0.01930	0.00589	0.01912
0.70	0.24557	8.62239	-0.04843	0.00928	0.60534	2.71265	2.73407	0.04532	0.75254	-0.00969	0.00376	0.01056
0.70	0.25574	8.36289	-0.05594	0.00957	0.69923	2.52884	2.83363	0.05316	0.99980	-0.00001	0.00183	0.00182
0.80	0.21506	9.38349	-0.02565	0.00853	0.32063	3.26908	2.45443	0.02253	0.00000	-0.03821	0.01084	0.03555
0.80	0.22680	9.01663	-0.03533	0.00887	0.44166	3.03560	2.58080	0.03079	0.25369	-0.02886	0.00800	0.02764
0.80	0.23855	8.64611	-0.04494	0.00925	0.56170	2.80410	2.71285	0.03923	0.50475	-0.01936	0.00552	0.01934
0.80	0.25029	8.27711	-0.05446	0.00967	0.68073	2.57436	2.85043	0.04784	0.75318	-0.00975	0.00336	0.01077
0.80	0.26203	7.91369	-0.06390	0.01011	0.79876	2.34607	2.99377	0.05659	0.99910	-0.00004	0.00146	0.00195
0.90	0.21506	9.38351	-0.02565	0.00853	0.32063	3.26909	2.45443	0.02253	0.00000	-0.03821	0.01084	0.03555
0.90	0.22882	8.80880	-0.03749	0.00908	0.46858	2.96607	2.64225	0.03194	0.25671	-0.02889	0.00768	0.02779
0.90	0.24258	8.24505	-0.04911	0.00970	0.61384	2.66769	2.83984	0.04157	0.50805	-0.01941	0.00510	0.01952
0.90	0.25635	7.70786	-0.06059	0.01038	0.75738	2.37314	3.04784	0.05141	0.75582	-0.00976	0.00296	0.01084
0.90	0.27011	7.19597	-0.07192	0.01112	0.89898	2.07914	3.27388	0.06152	0.99980	-0.00001	0.00117	0.00186

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.100 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.30	0.17503	17.28987	-0.05030	0.00925	0.31435	3.64261	2.79452	0.00000	0.25594	-0.05853	0.01634	0.05508
0.30	0.17908	17.38541	-0.04971	0.00920	0.31071	3.61600	2.78240	0.00581	0.44167	-0.04388	0.01476	0.04123
0.30	0.18313	17.48193	-0.04913	0.00915	0.30706	3.58943	2.77027	0.01160	0.62761	-0.02924	0.01316	0.02740
0.30	0.18717	17.57945	-0.04854	0.00910	0.30338	3.56290	2.75814	0.01738	0.81370	-0.01462	0.01154	0.01359
0.30	0.19122	17.67801	-0.04795	0.00905	0.29969	3.53641	2.74600	0.02315	0.99998	-0.00000	0.00990	-0.00020
0.40	0.17719	17.06850	-0.05374	0.00937	0.33585	3.58438	2.83559	0.00000	0.20644	-0.06261	0.01614	0.05922
0.40	0.18466	16.97876	-0.05628	0.00942	0.35178	3.49276	2.85937	0.00778	0.40527	-0.04700	0.01392	0.04470
0.40	0.19212	16.88733	-0.05883	0.00947	0.36771	3.40114	2.88341	0.01559	0.60379	-0.03136	0.01175	0.03012
0.40	0.19958	16.79431	-0.06138	0.00953	0.38365	3.30951	2.90773	0.02343	0.80204	-0.01569	0.00962	0.01550
0.40	0.20705	16.69975	-0.06393	0.00958	0.39959	3.21790	2.93232	0.03130	0.99999	-0.00000	0.00754	0.00083
0.50	0.17865	16.81689	-0.05617	0.00951	0.35104	3.53604	2.87803	-0.00000	0.17688	-0.06513	0.01596	0.06179
0.50	0.18948	16.41382	-0.06212	0.00975	0.38828	3.36769	2.95852	0.00957	0.38411	-0.04899	0.01316	0.04696
0.50	0.20030	16.01288	-0.06807	0.00999	0.42543	3.19970	3.04100	0.01926	0.59034	-0.03275	0.01054	0.03195
0.50	0.21113	15.61549	-0.07400	0.01025	0.46250	3.03207	3.12545	0.02905	0.79561	-0.01642	0.00810	0.01675
0.50	0.22196	15.22288	-0.07992	0.01051	0.49949	2.86477	3.21185	0.03896	0.99999	-0.00000	0.00582	0.00139
0.60	0.17981	16.70593	-0.05774	0.00958	0.36085	3.50638	2.89894	0.00000	0.14901	-0.06743	0.01587	0.06411
0.60	0.19485	16.05196	-0.06734	0.00997	0.42087	3.25622	3.03048	0.01186	0.36389	-0.05082	0.01239	0.04911
0.60	0.20988	15.40869	-0.07690	0.01036	0.48062	3.00706	3.16699	0.02396	0.57727	-0.03403	0.00927	0.03374
0.60	0.22492	14.78089	-0.08642	0.01082	0.54012	2.75885	3.30840	0.03626	0.78926	-0.01708	0.00647	0.01806
0.60	0.23996	14.17191	-0.09590	0.01129	0.59940	2.51152	3.45466	0.04874	0.99999	-0.00000	0.00395	0.00210
0.70	0.18058	16.56113	-0.05931	0.00966	0.37071	3.47865	2.92441	0.00000	0.13594	-0.06858	0.01576	0.06529
0.70	0.19869	15.60716	-0.07259	0.01025	0.45370	3.15412	3.11635	0.01337	0.35500	-0.05178	0.01184	0.05026
0.70	0.21679	14.69042	-0.08578	0.01089	0.53611	2.83176	3.31805	0.02710	0.57191	-0.03472	0.00847	0.03469
0.70	0.23489	13.82094	-0.09888	0.01158	0.61803	2.51152	3.52897	0.04112	0.78701	-0.01744	0.00557	0.01865
0.70	0.25299	12.99854	-0.11189	0.01231	0.69934	2.19292	3.74935	0.05538	1.00008	0.00001	0.00307	0.00226
0.80	0.18126	16.37128	-0.06065	0.00977	0.37905	3.44900	2.95610	-0.00000	0.12518	-0.06957	0.01564	0.06631
0.80	0.20258	15.01743	-0.07773	0.01065	0.48584	3.03748	3.23099	0.01495	0.34843	-0.05262	0.01127	0.05126
0.80	0.22389	13.75496	-0.09456	0.01163	0.59099	2.62948	3.52460	0.03037	0.56758	-0.03539	0.00774	0.03551
0.80	0.24520	12.61746	-0.11130	0.01268	0.69561	2.22628	3.83406	0.04621	0.78508	-0.01779	0.00484	0.01906
0.80	0.26652	11.58843	-0.12790	0.01381	0.79937	1.82607	4.16169	0.06237	1.00036	0.00003	0.00246	0.00218
0.90	0.18191	16.08403	-0.06144	0.00995	0.38402	3.41248	3.00012	-0.00007	0.11236	-0.07078	0.01550	0.06752
0.90	0.20768	14.01734	-0.08221	0.01141	0.51380	2.86301	3.43058	0.01698	0.33710	-0.05404	0.01058	0.05276
0.90	0.23345	12.34425	-0.10323	0.01296	0.64519	2.33264	3.87908	0.03498	0.56369	-0.03618	0.00688	0.03635
0.90	0.25922	10.87455	-0.12354	0.01471	0.77213	1.80384	4.37386	0.05337	0.78204	-0.01833	0.00410	0.01951
0.90	0.28499	9.72189	-0.14470	0.01646	0.90438	1.29426	4.87784	0.07235	1.00905	0.00077	0.00189	0.00120

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.100 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.19130	3.64314	-0.00799	0.02196	0.09990	6.51997	5.93056	0.06383	1.00000	0.00000	0.00395	-0.00098
0.10	0.19373	3.59651	-0.01230	0.02224	0.15375	6.42658	6.01707	0.06422	0.75005	-0.01082	0.00392	0.00984
0.10	0.19616	3.55045	-0.01661	0.02253	0.20758	6.33324	6.10445	0.06461	0.50006	-0.02166	0.00390	0.02069
0.10	0.19859	3.50494	-0.02091	0.02282	0.26140	6.23993	6.19271	0.06500	0.25006	-0.03252	0.00388	0.03156
0.10	0.20102	3.45999	-0.02522	0.02312	0.31521	6.14667	6.28184	0.06538	0.00000	-0.04341	0.00385	0.04245
0.20	0.20102	5.43898	0.12370	0.01471	-1.54628	7.85131	3.66992	0.23304	15.83980	0.61078	-0.02890	-0.59569
0.20	0.20105	5.41802	0.12223	0.01477	-1.52784	7.83369	3.69053	0.23169	15.68708	0.60495	-0.02839	-0.59011
0.20	0.20108	5.39507	0.12060	0.01483	-1.50755	7.81442	3.71318	0.23019	15.51896	0.59852	-0.02783	-0.58395
0.20	0.20110	5.37219	0.11901	0.01489	-1.48762	7.79547	3.73567	0.22872	15.35366	0.59219	-0.02728	-0.57787
0.20	0.20113	5.34875	0.11738	0.01496	-1.46730	7.77592	3.75892	0.22721	15.18506	0.58571	-0.02673	-0.57166
0.30	0.20102	3.45998	-0.02522	0.02312	0.31521	6.14666	6.28185	0.06538	0.00002	-0.04340	0.00385	0.04245
0.30	0.20245	3.46683	-0.02491	0.02308	0.31133	6.12634	6.27068	0.07001	0.24993	-0.03255	0.00341	0.03182
0.30	0.20388	3.47370	-0.02460	0.02303	0.30746	6.10602	6.25952	0.07463	0.49991	-0.02170	0.00297	0.02119
0.30	0.20530	3.48059	-0.02429	0.02298	0.30358	6.08571	6.24837	0.07925	0.74991	-0.01085	0.00252	0.01056
0.30	0.20673	3.48752	-0.02398	0.02294	0.29969	6.06540	6.23721	0.08387	0.99997	-0.00000	0.00207	-0.00006
0.40	0.20102	3.45998	-0.02522	0.02312	0.31521	6.14666	6.28185	0.06538	0.00001	-0.04340	0.00385	0.04245
0.40	0.20350	3.44650	-0.02690	0.02321	0.33630	6.08652	6.31111	0.07118	0.25012	-0.03256	0.00331	0.03188
0.40	0.20599	3.43304	-0.02859	0.02330	0.35740	6.02639	6.34048	0.07699	0.50015	-0.02171	0.00277	0.02129
0.40	0.20847	3.41962	-0.03028	0.02339	0.37850	5.96627	6.36995	0.08280	0.75010	-0.01086	0.00224	0.01071
0.40	0.21095	3.40623	-0.03197	0.02349	0.39959	5.90614	6.39954	0.08861	0.99998	-0.00000	0.00171	0.00011
0.50	0.20102	3.45998	-0.02522	0.02312	0.31521	6.14666	6.28185	0.06538	0.00001	-0.04340	0.00385	0.04245
0.50	0.20452	3.41785	-0.02890	0.02341	0.36131	6.04232	6.36658	0.07225	0.25034	-0.03257	0.00322	0.03192
0.50	0.20801	3.37627	-0.03259	0.02369	0.40739	5.93803	6.45205	0.07914	0.50044	-0.02172	0.00261	0.02136
0.50	0.21150	3.33523	-0.03628	0.02399	0.45345	5.83378	6.53826	0.08604	0.75032	-0.01087	0.00202	0.01081
0.50	0.21499	3.29473	-0.03996	0.02428	0.49949	5.72958	6.62520	0.09296	0.99999	-0.00000	0.00145	0.00022
0.60	0.20102	3.45998	-0.02522	0.02312	0.31521	6.14666	6.28185	0.06538	0.00001	-0.04340	0.00385	0.04245
0.60	0.20570	3.39512	-0.03091	0.02356	0.38635	5.99806	6.41252	0.07359	0.25048	-0.03258	0.00311	0.03199
0.60	0.21037	3.33158	-0.03659	0.02401	0.45742	5.84957	6.54493	0.08182	0.50062	-0.02174	0.00241	0.02149
0.60	0.21504	3.26936	-0.04228	0.02447	0.52844	5.70121	6.67905	0.09008	0.75045	-0.01088	0.00173	0.01095
0.60	0.21971	3.20845	-0.04795	0.02493	0.59940	5.55294	6.81488	0.09835	1.00000	-0.00000	0.00108	0.00039
0.70	0.20102	3.45998	-0.02522	0.02312	0.31521	6.14666	6.28185	0.06538	0.00001	-0.04340	0.00385	0.04245
0.70	0.20657	3.36898	-0.03291	0.02375	0.41143	5.95807	6.46471	0.07447	0.25067	-0.03259	0.00305	0.03202
0.70	0.21211	3.28067	-0.04060	0.02439	0.50750	5.76971	6.65088	0.08359	0.50085	-0.02175	0.00229	0.02155
0.70	0.21765	3.19511	-0.04828	0.02504	0.60348	5.58164	6.84022	0.09274	0.75066	-0.01088	0.00158	0.01102
0.70	0.22319	3.11215	-0.05594	0.02571	0.69931	5.39375	7.03288	0.10192	1.00000	-0.00000	0.00092	0.00046
0.80	0.20102	3.45999	-0.02522	0.02312	0.31521	6.14666	6.28184	0.06538	0.00001	-0.04340	0.00385	0.04245
0.80	0.20747	3.33456	-0.03493	0.02399	0.43659	5.91185	6.53326	0.07537	0.25097	-0.03260	0.00299	0.03206
0.80	0.21392	3.21430	-0.04460	0.02489	0.55753	5.67742	6.79028	0.08540	0.50091	-0.02178	0.00220	0.02161
0.80	0.22036	3.10006	-0.05429	0.02581	0.67866	5.44386	7.05249	0.09549	0.75112	-0.01089	0.00146	0.01106
0.80	0.22681	2.98907	-0.06387	0.02676	0.79842	5.20956	7.32288	0.10557	0.99840	-0.00007	0.00080	0.00056
0.90	0.20102	3.45998	-0.02522	0.02312	0.31521	6.14666	6.28185	0.06538	0.00001	-0.04340	0.00385	0.04245
0.90	0.20868	3.27970	-0.03708	0.02439	0.46353	5.84362	6.64910	0.07671	0.25424	-0.03249	0.00290	0.03198
0.90	0.21634	3.10716	-0.04865	0.02575	0.60811	5.54028	7.01964	0.08800	0.50191	-0.02178	0.00208	0.02164
0.90	0.22399	2.94959	-0.06040	0.02712	0.75498	5.23876	7.41250	0.09936	0.75336	-0.01082	0.00134	0.01102
0.90	0.23165	2.81646	-0.07302	0.02840	0.91276	4.94794	7.79831	0.11113	1.02337	0.00103	0.00063	-0.00050

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.100 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.15980	6.96812	-0.01598	0.02296	0.09990	7.31035	6.25728	0.02724	0.99999	-0.00000	0.00746	-0.00185
0.10	0.16466	6.78929	-0.02459	0.02357	0.15369	7.12384	6.43801	0.02791	0.75007	-0.02173	0.00730	0.01992
0.10	0.16953	6.61519	-0.03319	0.02419	0.20746	6.93748	6.62222	0.02857	0.50008	-0.04355	0.00715	0.04178
0.10	0.17439	6.44580	-0.04179	0.02482	0.26120	6.75127	6.80990	0.02922	0.25006	-0.06545	0.00701	0.06372
0.10	0.17926	6.28113	-0.05038	0.02547	0.31491	6.56519	7.00105	0.02986	0.00000	-0.08743	0.00688	0.08573
0.20	0.17926	10.84824	0.12424	0.01475	-0.77651	8.55711	3.75895	0.23146	9.30721	0.68602	-0.02760	-0.67007
0.20	0.17931	10.76423	0.12143	0.01486	-0.75894	8.52357	3.79921	0.22886	9.16192	0.67497	-0.02666	-0.65948
0.20	0.17937	10.67599	0.11850	0.01499	-0.74061	8.48858	3.84180	0.22612	9.01006	0.66337	-0.02569	-0.64835
0.20	0.17942	10.58229	0.11542	0.01512	-0.72138	8.45192	3.88706	0.22322	8.85048	0.65113	-0.02470	-0.63660
0.20	0.17948	10.48511	0.11217	0.01526	-0.70105	8.41339	3.93532	0.22011	8.68151	0.63810	-0.02367	-0.62408
0.30	0.17926	6.28112	-0.05039	0.02547	0.31491	6.56518	7.00106	0.02986	0.00000	-0.08743	0.00688	0.08573
0.30	0.18212	6.30495	-0.04978	0.02538	0.31111	6.52417	6.97751	0.03924	0.24990	-0.06557	0.00610	0.06426
0.30	0.18498	6.32895	-0.04917	0.02528	0.30731	6.48317	6.95398	0.04861	0.49987	-0.04371	0.00532	0.04279
0.30	0.18785	6.35312	-0.04856	0.02518	0.30351	6.44213	6.93047	0.05798	0.74988	-0.02185	0.00453	0.02134
0.30	0.19071	6.37749	-0.04795	0.02509	0.29969	6.40121	6.90696	0.06734	0.99998	-0.00000	0.00373	-0.00011
0.40	0.17926	6.28111	-0.05039	0.02547	0.31491	6.56519	7.00106	0.02986	0.00000	-0.08743	0.00688	0.08573
0.40	0.18424	6.23116	-0.05377	0.02568	0.33608	6.44454	7.06475	0.04158	0.25020	-0.06559	0.00588	0.06437
0.40	0.18922	6.18152	-0.05716	0.02588	0.35725	6.32392	7.12886	0.05331	0.50026	-0.04374	0.00491	0.04300
0.40	0.19421	6.13221	-0.06055	0.02609	0.37842	6.20330	7.19340	0.06506	0.75019	-0.02188	0.00395	0.02160
0.40	0.19919	6.08325	-0.06393	0.02630	0.39959	6.08270	7.25835	0.07682	1.00000	-0.00000	0.00302	0.00016
0.50	0.17926	6.28112	-0.05039	0.02547	0.31491	6.56517	7.00106	0.02986	0.00000	-0.08743	0.00688	0.08573
0.50	0.18628	6.12886	-0.05778	0.02611	0.36111	6.35604	7.18484	0.04370	0.25058	-0.06563	0.00569	0.06448
0.50	0.19330	5.98097	-0.06516	0.02675	0.40727	6.14706	7.37158	0.05758	0.50076	-0.04378	0.00456	0.04317
0.50	0.20032	5.83734	-0.07254	0.02741	0.45340	5.93824	7.56127	0.07152	0.75055	-0.02191	0.00349	0.02179
0.50	0.20735	5.69791	-0.07992	0.02808	0.49949	5.72957	7.75388	0.08549	0.99999	-0.00000	0.00248	0.00036
0.60	0.17926	6.28114	-0.05039	0.02547	0.31491	6.56517	7.00105	0.02986	0.00001	-0.08743	0.00688	0.08573
0.60	0.18866	6.04796	-0.06179	0.02646	0.38518	6.26739	7.28497	0.04636	0.25090	-0.06566	0.00546	0.06461
0.60	0.19806	5.82516	-0.07318	0.02747	0.45735	5.96998	7.57578	0.06295	0.50104	-0.04383	0.00415	0.04336
0.60	0.20746	5.61249	-0.08455	0.02851	0.52843	5.67298	7.87342	0.07961	0.75077	-0.02194	0.00294	0.02205
0.60	0.21686	5.40948	-0.09590	0.02958	0.59940	5.37633	8.17791	0.09634	1.00001	0.00000	0.00183	0.00061
0.70	0.17926	6.28111	-0.05039	0.02547	0.31491	6.56519	7.00106	0.02986	0.00000	-0.08743	0.00688	0.08573
0.70	0.19042	5.95610	-0.06581	0.02686	0.41132	6.18716	7.39920	0.04810	0.25110	-0.06569	0.00530	0.06470
0.70	0.20158	5.65192	-0.08120	0.02831	0.50751	5.80996	7.81042	0.06646	0.50141	-0.04387	0.00390	0.04351
0.70	0.21274	5.36737	-0.09656	0.02981	0.60348	5.43349	8.23464	0.08493	0.75097	-0.02197	0.00264	0.02217
0.70	0.22391	5.10147	-0.11189	0.03136	0.69930	5.05777	8.67184	0.10349	0.99998	-0.00000	0.00151	0.00070
0.80	0.17926	6.28111	-0.05039	0.02547	0.31491	6.56519	7.00106	0.02986	0.00000	-0.08743	0.00689	0.08573
0.80	0.19226	5.83732	-0.06985	0.02741	0.43656	6.09437	7.54905	0.04988	0.25150	-0.06573	0.00515	0.06479
0.80	0.20527	5.43423	-0.08926	0.02944	0.55790	5.62533	8.12087	0.07008	0.50211	-0.04390	0.00366	0.04360
0.80	0.21828	5.06723	-0.10860	0.03158	0.67877	5.15762	8.71539	0.09041	0.75158	-0.02198	0.00233	0.02223
0.80	0.23128	4.73369	-0.12791	0.03380	0.79943	4.69128	9.33507	0.11087	1.00048	0.00004	0.00128	0.00067
0.90	0.17926	6.28113	-0.05039	0.02547	0.31491	6.56518	7.00105	0.02986	0.00001	-0.08743	0.00688	0.08573
0.90	0.19485	5.64512	-0.07400	0.02834	0.46249	5.95427	7.79318	0.05243	0.25295	-0.06572	0.00494	0.06483
0.90	0.21045	5.09232	-0.09742	0.03142	0.60884	5.34545	8.63969	0.07517	0.50356	-0.04391	0.00338	0.04366
0.90	0.22605	4.62176	-0.12113	0.03462	0.75706	4.74362	9.52825	0.09825	0.75714	-0.02158	0.00209	0.02165
0.90	0.24164	4.21954	-0.14521	0.03792	0.90757	4.14891	10.45833	0.12184	1.01447	0.00129	0.00101	-0.00058

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.200 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.29466	4.34412	-0.00799	0.01842	0.09991	3.58929	1.35259	0.03194	0.99995	-0.00000	0.02627	-0.00890
0.10	0.29881	4.37412	-0.01264	0.01829	0.15794	3.49482	1.36092	0.03256	0.75047	-0.00661	0.02516	-0.00140
0.10	0.30296	4.40253	-0.01727	0.01817	0.21593	3.40046	1.36944	0.03319	0.50067	-0.01331	0.02410	0.00614
0.10	0.30711	4.42929	-0.02191	0.01806	0.27387	3.30623	1.37817	0.03381	0.25053	-0.02010	0.02309	0.01373
0.10	0.31126	4.45436	-0.02654	0.01796	0.33178	3.21211	1.38711	0.03443	0.00007	-0.02696	0.02213	0.02136
0.20	0.31126	4.45435	-0.02654	0.01796	0.33179	3.21208	1.38711	0.03443	0.00000	-0.02697	0.02213	0.02137
0.20	0.31126	4.44350	-0.02391	0.01800	0.29890	3.24412	1.38155	0.03559	0.25000	-0.02015	0.02067	0.01507
0.20	0.31124	4.43191	-0.02128	0.01805	0.26594	3.27631	1.37605	0.03672	0.50000	-0.01339	0.01919	0.00883
0.20	0.31123	4.41957	-0.01863	0.01810	0.23291	3.30866	1.37061	0.03784	0.75000	-0.00667	0.01770	0.00263
0.20	0.31121	4.40650	-0.01598	0.01816	0.19980	3.34116	1.36525	0.03893	1.00000	0.00000	0.01619	-0.00351
0.30	0.31126	4.45435	-0.02654	0.01796	0.33179	3.21207	1.38711	0.03443	0.00009	-0.02696	0.02213	0.02136
0.30	0.31347	4.45536	-0.02591	0.01796	0.32383	3.20213	1.38483	0.03649	0.24953	-0.02021	0.01944	0.01585
0.30	0.31568	4.45621	-0.02527	0.01795	0.31583	3.19225	1.38255	0.03854	0.49929	-0.01346	0.01672	0.01035
0.30	0.31789	4.45692	-0.02462	0.01795	0.30778	3.18241	1.38026	0.04058	0.74940	-0.00673	0.01399	0.00486
0.30	0.32009	4.45750	-0.02398	0.01795	0.29970	3.17262	1.37799	0.04261	0.99987	-0.00000	0.01124	-0.00060
0.40	0.31126	4.45437	-0.02654	0.01796	0.33180	3.21208	1.38711	0.03443	0.00006	-0.02696	0.02213	0.02137
0.40	0.31503	4.46574	-0.02790	0.01791	0.34873	3.16572	1.38862	0.03716	0.25027	-0.02024	0.01855	0.01645
0.40	0.31879	4.47711	-0.02925	0.01787	0.36567	3.11938	1.39014	0.03989	0.50032	-0.01350	0.01499	0.01152
0.40	0.32255	4.48846	-0.03061	0.01782	0.38263	3.07301	1.39167	0.04262	0.75021	-0.00675	0.01144	0.00658
0.40	0.32632	4.49979	-0.03197	0.01778	0.39959	3.02665	1.39321	0.04537	0.99992	-0.00000	0.00792	0.00161
0.50	0.31126	4.45437	-0.02654	0.01796	0.33180	3.21207	1.38711	0.03443	0.00004	-0.02696	0.02213	0.02137
0.50	0.31635	4.47112	-0.02990	0.01789	0.37379	3.12511	1.39452	0.03781	0.25127	-0.02028	0.01776	0.01709
0.50	0.32143	4.48669	-0.03326	0.01783	0.41573	3.03825	1.40206	0.04122	0.50167	-0.01356	0.01351	0.01270
0.50	0.32651	4.50103	-0.03661	0.01777	0.45763	2.95147	1.40973	0.04467	0.75122	-0.00680	0.00937	0.00821
0.50	0.33160	4.51414	-0.03996	0.01772	0.49949	2.86480	1.41755	0.04816	0.99995	-0.00000	0.00535	0.00361
0.60	0.31126	4.45438	-0.02654	0.01796	0.33180	3.21207	1.38711	0.03443	0.00004	-0.02696	0.02213	0.02137
0.60	0.31809	4.47934	-0.03192	0.01786	0.39895	3.08434	1.39909	0.03858	0.25182	-0.02032	0.01680	0.01774
0.60	0.32493	4.50115	-0.03727	0.01777	0.46593	2.95690	1.41141	0.04280	0.50240	-0.01362	0.01170	0.01392
0.60	0.33176	4.51975	-0.04262	0.01770	0.53274	2.82976	1.42407	0.04709	0.75177	-0.00684	0.00683	0.00989
0.60	0.33859	4.53515	-0.04795	0.01764	0.59939	2.70291	1.43707	0.05146	0.99996	-0.00000	0.00216	0.00566
0.70	0.31126	4.45437	-0.02654	0.01796	0.33180	3.21206	1.38711	0.03443	0.00003	-0.02696	0.02213	0.02137
0.70	0.31921	4.48433	-0.03395	0.01784	0.42423	3.04719	1.40471	0.03913	0.25271	-0.02037	0.01617	0.01826
0.70	0.32716	4.50767	-0.04132	0.01775	0.51646	2.88303	1.42297	0.04395	0.50368	-0.01367	0.01059	0.01485
0.70	0.33511	4.52382	-0.04864	0.01768	0.60802	2.71967	1.44190	0.04883	0.75252	-0.00689	0.00537	0.01109
0.70	0.34306	4.53358	-0.05594	0.01765	0.69925	2.55693	1.46154	0.05393	0.99984	-0.00000	0.00048	0.00701
0.80	0.31126	4.45437	-0.02654	0.01796	0.33180	3.21207	1.38711	0.03443	0.00003	-0.02696	0.02213	0.02137
0.80	0.32026	4.48348	-0.03601	0.01784	0.45017	3.00368	1.41267	0.03975	0.25430	-0.02042	0.01555	0.01886
0.80	0.32926	4.49859	-0.04540	0.01778	0.56746	2.79699	1.43951	0.04524	0.50556	-0.01374	0.00959	0.01579
0.80	0.33825	4.50080	-0.05471	0.01777	0.68384	2.59199	1.46760	0.05090	0.75420	-0.00693	0.00418	0.01220
0.80	0.34725	4.48983	-0.06393	0.01782	0.79907	2.38858	1.49699	0.05672	0.99973	-0.00001	-0.00071	0.00815
0.90	0.31126	4.45440	-0.02654	0.01796	0.33181	3.21208	1.38711	0.03443	0.00003	-0.02696	0.02213	0.02137
0.90	0.32171	4.46436	-0.03818	0.01792	0.47724	2.93710	1.42699	0.04069	0.25768	-0.02049	0.01430	0.01956
0.90	0.33215	4.44116	-0.04951	0.01801	0.61884	2.66692	1.46935	0.04717	0.50764	-0.01390	0.00861	0.01661
0.90	0.34260	4.39761	-0.06078	0.01819	0.75973	2.40007	1.51448	0.05394	0.75554	-0.00705	0.00322	0.01316
0.90	0.35305	4.33868	-0.07202	0.01844	0.90030	2.13733	1.56202	0.06098	1.00210	0.00006	-0.00147	0.00873

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.200 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	L	YC(1)	M	ACAP	BINT	DINT
0.10	0.23390	8.94882	-0.01598	0.01788	0.09991	4.31381	1.37790	0.01292	0.99997	-0.00000	0.05038	-0.01688
0.10	0.24219	9.04781	-0.02522	0.01768	0.15760	4.12614	1.39602	0.01384	0.75092	-0.01351	0.04766	-0.00148
0.10	0.25048	9.13218	-0.03443	0.01752	0.21521	3.93897	1.41498	0.01475	0.50124	-0.02735	0.04514	0.01411
0.10	0.25877	9.20133	-0.04364	0.01739	0.27272	3.75229	1.43482	0.01565	0.25093	-0.04154	0.04280	0.02989
0.10	0.26706	9.25476	-0.05282	0.01729	0.33015	3.56610	1.45556	0.01655	0.00003	-0.05606	0.04064	0.04586
0.20	0.26707	9.25475	-0.05283	0.01729	0.33016	3.56607	1.45556	0.01655	0.00000	-0.05606	0.04064	0.04587
0.20	0.26710	9.24269	-0.04764	0.01731	0.29778	3.62806	1.44275	0.01926	0.25000	-0.04177	0.03820	0.03251
0.20	0.26712	9.22440	-0.04244	0.01735	0.26526	3.69062	1.43022	0.02190	0.50000	-0.02766	0.03569	0.01935
0.20	0.26712	9.19983	-0.03722	0.01739	0.23260	3.75378	1.41795	0.02446	0.75000	-0.01373	0.03312	0.00638
0.20	0.26710	9.16887	-0.03197	0.01745	0.19980	3.81752	1.40596	0.02694	1.00000	0.00000	0.03049	-0.00640
0.30	0.26707	9.25473	-0.05282	0.01729	0.33016	3.56606	1.45556	0.01655	0.00003	-0.05606	0.04064	0.04586
0.30	0.27155	9.27302	-0.05162	0.01725	0.32265	3.54440	1.45048	0.02105	0.24907	-0.04199	0.03582	0.03406
0.30	0.27604	9.29045	-0.05041	0.01722	0.31508	3.52291	1.44540	0.02551	0.49874	-0.02795	0.03092	0.02232
0.30	0.28052	9.30701	-0.04919	0.01719	0.30742	3.50159	1.44032	0.02994	0.74902	-0.01396	0.02596	0.01065
0.30	0.28501	9.32266	-0.04795	0.01716	0.29970	3.48044	1.43525	0.03434	0.99995	-0.00000	0.02091	-0.00095
0.40	0.26707	9.25472	-0.05283	0.01729	0.33016	3.56606	1.45556	0.01655	0.00002	-0.05606	0.04064	0.04586
0.40	0.27471	9.29261	-0.05560	0.01722	0.34749	3.47171	1.45943	0.02234	0.25055	-0.04210	0.03405	0.03523
0.40	0.28236	9.33002	-0.05837	0.01715	0.36484	3.37735	1.46335	0.02816	0.50073	-0.02810	0.02753	0.02453
0.40	0.29001	9.36693	-0.06115	0.01708	0.38221	3.28293	1.46734	0.03401	0.75052	-0.01407	0.02109	0.01375
0.40	0.29765	9.40332	-0.06393	0.01702	0.39959	3.18848	1.47138	0.03990	0.99996	-0.00000	0.01472	0.00291
0.50	0.26707	9.25477	-0.05283	0.01729	0.33016	3.56606	1.45556	0.01655	0.00002	-0.05606	0.04064	0.04586
0.50	0.27746	9.27728	-0.05962	0.01725	0.37264	3.39014	1.47342	0.02355	0.25254	-0.04228	0.03239	0.03647
0.50	0.28785	9.28886	-0.06640	0.01722	0.41502	3.21461	1.49189	0.03071	0.50335	-0.02834	0.02458	0.02666
0.50	0.29824	9.28969	-0.07317	0.01722	0.45730	3.03949	1.51098	0.03804	0.75248	-0.01425	0.01717	0.01647
0.50	0.30863	9.27994	-0.07992	0.01724	0.49949	2.86477	1.53069	0.04552	0.99998	-0.00000	0.01017	0.00589
0.60	0.26707	9.25477	-0.05283	0.01729	0.33016	3.56607	1.45556	0.01655	0.00002	-0.05606	0.04064	0.04587
0.60	0.28105	9.27979	-0.06368	0.01724	0.39800	3.30795	1.48453	0.02507	0.25364	-0.04244	0.03051	0.03773
0.60	0.29504	9.27706	-0.07448	0.01725	0.46548	3.05106	1.51502	0.03391	0.50480	-0.02855	0.02123	0.02881
0.60	0.30902	9.24777	-0.08522	0.01730	0.53261	2.79542	1.54703	0.04305	0.75356	-0.01440	0.01273	0.01916
0.60	0.32301	9.19345	-0.09590	0.01740	0.59940	2.54101	1.58056	0.05248	0.99999	-0.00000	0.00496	0.00882
0.70	0.26707	9.25475	-0.05283	0.01729	0.33016	3.56605	1.45556	0.01655	0.00001	-0.05606	0.04064	0.04587
0.70	0.28343	9.25994	-0.06781	0.01728	0.42380	3.23235	1.49831	0.02612	0.25543	-0.04261	0.02919	0.03875
0.70	0.29980	9.20929	-0.08264	0.01737	0.51653	2.90164	1.54405	0.03618	0.50716	-0.02877	0.01912	0.03035
0.70	0.31616	9.10740	-0.09733	0.01757	0.60831	2.57384	1.59280	0.04669	0.75518	-0.01456	0.01029	0.02092
0.70	0.33252	8.96270	-0.11189	0.01785	0.69928	2.24902	1.64446	0.05763	0.99994	-0.00000	0.00255	0.01025
0.80	0.26707	9.25476	-0.05283	0.01729	0.33016	3.56605	1.45556	0.01655	0.00001	-0.05606	0.04064	0.04587
0.80	0.28576	9.19688	-0.07207	0.01740	0.45047	3.14242	1.51821	0.02729	0.25849	-0.04282	0.02782	0.03984
0.80	0.30445	9.03640	-0.09100	0.01771	0.56873	2.72557	1.58653	0.03874	0.51116	-0.02901	0.01721	0.03176
0.80	0.32314	8.79812	-0.10961	0.01819	0.68507	2.31634	1.65976	0.05082	0.75848	-0.01470	0.00842	0.02196
0.80	0.34184	8.49334	-0.12787	0.01884	0.79916	1.91190	1.73884	0.06345	0.99994	-0.00000	0.00116	0.01084
0.90	0.26707	9.25482	-0.05283	0.01729	0.33017	3.56607	1.45556	0.01655	0.00002	-0.05606	0.04064	0.04587
0.90	0.28908	8.99026	-0.07651	0.01780	0.47821	2.99898	1.55618	0.02904	0.26271	-0.04325	0.02611	0.04121
0.90	0.31110	8.58679	-0.09967	0.01863	0.62294	2.45601	1.66495	0.04260	0.51762	-0.02940	0.01521	0.03301
0.90	0.33312	8.08275	-0.12215	0.01980	0.76343	1.92528	1.78533	0.05704	0.76361	-0.01490	0.00696	0.02238
0.90	0.35513	7.52369	-0.14372	0.02127	0.89822	1.40640	1.91565	0.07206	0.99846	-0.00010	0.00075	0.01018

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.13966	17.45015	-0.00799	0.00458	0.09991	3.73419	0.00603	0.99996	-0.00000
0.10	0.14515	16.80507	-0.01224	0.00476	0.15305	3.63334	0.00633	0.74998	-0.01273
0.10	0.15064	16.19508	-0.01650	0.00494	0.20620	3.53249	0.00662	0.50001	-0.02546
0.10	0.15613	15.61776	-0.02075	0.00512	0.25934	3.43163	0.00691	0.25003	-0.03820
0.10	0.16161	15.07072	-0.02500	0.00531	0.31249	3.33073	0.00720	0.00005	-0.05093
0.30	0.16162	15.07064	-0.02500	0.00531	0.31250	3.33075	0.00720	0.00007	-0.05093
0.30	0.16483	15.12280	-0.02474	0.00529	0.30930	3.30661	0.01291	0.25003	-0.03820
0.30	0.16905	15.17524	-0.02449	0.00527	0.30610	3.28247	0.01861	0.49999	-0.02547
0.30	0.17126	15.22796	-0.02423	0.00525	0.30290	3.25833	0.02432	0.74995	-0.01274
0.30	0.17448	15.28096	-0.02398	0.00524	0.29969	3.23419	0.03002	0.99992	-0.00000
0.50	0.16162	15.07056	-0.02500	0.00531	0.31251	3.33074	0.00720	0.00003	-0.05093
0.50	0.16963	14.56670	-0.02874	0.00549	0.35925	3.21425	0.01557	0.25001	-0.03820
0.50	0.17763	14.08770	-0.03249	0.00568	0.40600	3.09776	0.02393	0.50000	-0.02546
0.50	0.18564	13.63194	-0.03622	0.00587	0.45274	2.98128	0.03229	0.74998	-0.01273
0.50	0.19365	13.19796	-0.03996	0.00606	0.49949	2.86479	0.04066	0.99997	-0.00000
0.70	0.16162	15.07053	-0.02500	0.00531	0.31251	3.33074	0.00720	0.00002	-0.05093
0.70	0.17438	14.03550	-0.03274	0.00570	0.40920	3.12188	0.01817	0.25001	-0.03820
0.70	0.18714	13.10408	-0.04047	0.00610	0.50590	2.91302	0.02914	0.50000	-0.02546
0.70	0.19990	12.26213	-0.04821	0.00652	0.60260	2.70416	0.04010	0.74999	-0.01273
0.70	0.21266	11.49881	-0.05594	0.00696	0.69930	2.49530	0.05107	0.99998	-0.00000
0.90	0.16162	15.07050	-0.02500	0.00531	0.31251	3.33074	0.00720	0.00001	-0.05093
0.90	0.17968	13.17081	-0.03673	0.00607	0.45916	2.99591	0.02063	0.25001	-0.03820
0.90	0.19775	11.60894	-0.04846	0.00689	0.60580	2.66107	0.03406	0.50000	-0.02546
0.90	0.21582	10.30926	-0.06020	0.00776	0.75245	2.32624	0.04749	0.74999	-0.01273
0.90	0.23388	9.21622	-0.07193	0.00868	0.89910	1.99141	0.06091	0.99998	-0.00000

CL= 0.10

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.30	0.15196	17.62262	-0.03109	0.00567	0.31093	3.43245	0.00000	0.12262	-0.05586
0.30	0.15549	17.68738	-0.03081	0.00565	0.30812	3.40597	0.00626	0.34195	-0.04189
0.30	0.15902	17.75243	-0.03053	0.00563	0.30531	3.37949	0.01251	0.56127	-0.02793
0.30	0.16254	17.81787	-0.03025	0.00561	0.30250	3.35302	0.01877	0.78060	-0.01397
0.30	0.16607	17.88370	-0.02997	0.00559	0.29969	3.32654	0.02503	0.99993	-0.00000
0.50	0.15334	17.34540	-0.03281	0.00577	0.32814	3.39854	0.00000	0.08363	-0.05834
0.50	0.16251	16.70959	-0.03710	0.00598	0.37098	3.26510	0.00958	0.31271	-0.04375
0.50	0.17169	16.10808	-0.04138	0.00621	0.41381	3.13166	0.01916	0.54180	-0.02917
0.50	0.18086	15.53848	-0.04567	0.00644	0.45665	2.99822	0.02874	0.77088	-0.01459
0.50	0.19004	14.99856	-0.04995	0.00667	0.49949	2.86477	0.03832	0.99997	-0.00000
0.70	0.15406	17.20068	-0.03372	0.00531	0.33717	3.38065	0.00000	0.06377	-0.05960
0.70	0.16899	15.88810	-0.04277	0.00629	0.42770	3.13621	0.01283	0.29783	-0.04470
0.70	0.18393	14.72022	-0.05182	0.00679	0.51823	2.89178	0.02567	0.53188	-0.02980
0.70	0.19886	13.67651	-0.06088	0.00731	0.60877	2.64735	0.03850	0.76593	-0.01490
0.70	0.21379	12.74000	-0.06993	0.00785	0.69930	2.40292	0.05134	0.99998	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
CL= 0.10									
0.90	0.15470	16.98564	-0.03431	0.00589	0.34305	3.36005	0.00000	0.05209	-0.06035
0.90	0.17610	14.60544	-0.04821	0.00685	0.48207	2.96330	0.01591	0.28906	-0.04526
0.90	0.19751	12.69260	-0.06211	0.00788	0.62108	2.56655	0.03182	0.52604	-0.03017
0.90	0.21892	11.13235	-0.07601	0.00898	0.76009	2.16981	0.04773	0.76301	-0.01509
0.90	0.24033	9.84305	-0.08991	0.01016	0.89910	1.77306	0.06364	0.99999	-0.00000
CL= 0.12									
0.30	0.14637	19.90631	-0.03686	0.00603	0.30719	3.50366	0.00000	0.41474	-0.04471
0.30	0.14919	19.96306	-0.03664	0.00601	0.30532	3.48247	0.00501	0.56104	-0.03353
0.30	0.15202	20.02005	-0.03641	0.00599	0.30344	3.46128	0.01002	0.70734	-0.02236
0.30	0.15484	20.07730	-0.03619	0.00598	0.30157	3.44008	0.01503	0.85364	-0.01118
0.30	0.15766	20.13478	-0.03596	0.00596	0.29969	3.41889	0.02003	0.99995	-0.00000
0.50	0.15196	18.71465	-0.04385	0.00641	0.36540	3.36600	0.00000	0.28289	-0.05478
0.50	0.16058	18.10196	-0.04787	0.00663	0.39892	3.24069	0.00900	0.46216	-0.04109
0.50	0.16919	17.51881	-0.05189	0.00685	0.43244	3.11539	0.01799	0.64143	-0.02739
0.50	0.17781	16.96344	-0.05592	0.00707	0.46597	2.99008	0.02699	0.82070	-0.01370
0.50	0.18643	16.43407	-0.05994	0.00730	0.49949	2.86477	0.03599	0.99998	-0.00000
0.70	0.15488	18.12411	-0.04751	0.00662	0.39595	3.29336	0.00000	0.21574	-0.05991
0.70	0.16990	16.81697	-0.05661	0.00714	0.47179	3.04766	0.01290	0.41181	-0.04493
0.70	0.18491	15.64628	-0.06572	0.00767	0.54763	2.80195	0.02580	0.60786	-0.02996
0.70	0.19992	14.59370	-0.07482	0.00822	0.62346	2.55625	0.03870	0.80393	-0.01498
0.70	0.21493	13.64389	-0.08392	0.00880	0.69930	2.31054	0.05160	0.99999	-0.00000
0.90	0.15747	17.28427	-0.04990	0.00694	0.41586	3.20973	0.00000	0.17621	-0.06293
0.90	0.17979	14.94831	-0.06440	0.00803	0.53667	2.79598	0.01659	0.38215	-0.04720
0.90	0.20212	13.05579	-0.07890	0.00919	0.65748	2.38222	0.03319	0.58810	-0.03147
0.90	0.22444	11.50117	-0.09339	0.01043	0.77829	1.96847	0.04978	0.79404	-0.01573
0.90	0.24677	10.20854	-0.10789	0.01175	0.89910	1.55471	0.06637	0.99999	-0.00000
CL= 0.14									
0.30	0.14078	21.90018	-0.04263	0.00639	0.30452	3.57488	0.00000	0.62340	-0.03357
0.30	0.14290	21.94566	-0.04246	0.00638	0.30331	3.55896	0.00376	0.71753	-0.02518
0.30	0.14502	21.99129	-0.04229	0.00637	0.30211	3.54306	0.00752	0.81167	-0.01678
0.30	0.14714	22.03708	-0.04213	0.00635	0.30090	3.52715	0.01128	0.90581	-0.00839
0.30	0.14926	22.08301	-0.04196	0.00634	0.29969	3.51124	0.01504	0.99995	-0.00000
0.50	0.15058	19.73680	-0.05488	0.00709	0.39201	3.33347	0.00000	0.42522	-0.05123
0.50	0.15864	19.16074	-0.05864	0.00731	0.41888	3.21629	0.00841	0.56891	-0.03842
0.50	0.16670	18.60951	-0.06241	0.00752	0.44575	3.09911	0.01683	0.71260	-0.02561
0.50	0.17475	18.08174	-0.06617	0.00774	0.47262	2.98194	0.02524	0.85629	-0.01281
0.50	0.18281	17.57613	-0.06993	0.00797	0.49949	2.86476	0.03365	0.99998	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.100

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
CL= 0.14									
0.70	0.15571	18.71469	-0.06131	0.00748	0.43794	3.20608	0.00000	0.32429	-0.06022
0.70	0.17080	17.43446	-0.07046	0.00803	0.50328	2.95910	0.01297	0.49322	-0.04517
0.70	0.18589	16.28125	-0.07961	0.00860	0.56862	2.71212	0.02594	0.66214	-0.03011
0.70	0.20098	15.23878	-0.08875	0.00919	0.63396	2.46515	0.03890	0.83106	-0.01506
0.70	0.21607	14.29332	-0.09790	0.00979	0.69930	2.21817	0.05187	0.99999	-0.00000
0.90	0.16024	17.31596	-0.06550	0.00809	0.46787	3.05942	0.00000	0.26486	-0.06552
0.90	0.18348	15.04983	-0.08059	0.00930	0.57568	2.62865	0.01727	0.44864	-0.04914
0.90	0.20673	13.20114	-0.09569	0.01061	0.68349	2.19789	0.03455	0.63243	-0.03276
0.90	0.22997	11.67329	-0.11078	0.01199	0.79129	1.76713	0.05182	0.81621	-0.01638
0.90	0.25321	10.39610	-0.12587	0.01347	0.89910	1.33636	0.06910	0.99999	-0.00000
CL= 0.16									
0.30	0.13518	23.64160	-0.04840	0.00677	0.30251	3.64609	0.00000	0.77989	-0.02242
0.30	0.13660	23.67348	-0.04829	0.00676	0.30181	3.63546	0.00251	0.83490	-0.01682
0.30	0.13802	23.70540	-0.04818	0.00675	0.30110	3.62484	0.00502	0.88992	-0.01121
0.30	0.13943	23.73737	-0.04806	0.00674	0.30040	3.61421	0.00754	0.94494	-0.00561
0.30	0.14085	23.76941	-0.04795	0.00673	0.29969	3.60358	0.01005	0.99996	-0.00000
0.50	0.14921	20.48921	-0.06592	0.00781	0.41198	3.30093	0.00000	0.53197	-0.04767
0.50	0.15670	19.95749	-0.06942	0.00802	0.43385	3.19189	0.00783	0.64898	-0.03576
0.50	0.16420	19.44617	-0.07292	0.00823	0.45573	3.08284	0.01566	0.76598	-0.02384
0.50	0.17170	18.95427	-0.07642	0.00844	0.47761	2.97380	0.02349	0.88298	-0.01192
0.50	0.17920	18.48080	-0.07992	0.00866	0.49949	2.86475	0.03132	0.99998	-0.00000
0.70	0.15653	19.06358	-0.07511	0.00839	0.46943	3.11880	0.00000	0.40571	-0.06053
0.70	0.17170	17.82274	-0.08430	0.00893	0.52690	2.87055	0.01304	0.55428	-0.04540
0.70	0.18687	16.69925	-0.09350	0.00958	0.58437	2.62230	0.02607	0.70285	-0.03027
0.70	0.20204	15.67874	-0.10269	0.01020	0.64183	2.37404	0.03911	0.85142	-0.01513
0.70	0.21720	14.74899	-0.11189	0.01085	0.69930	2.12579	0.05214	0.99999	-0.00000
0.90	0.16301	17.17772	-0.08110	0.00931	0.50688	2.90910	0.00000	0.33136	-0.06811
0.90	0.18717	14.99377	-0.09679	0.01067	0.60493	2.46133	0.01796	0.49851	-0.05108
0.90	0.21133	13.20125	-0.11248	0.01212	0.70299	2.01356	0.03591	0.66567	-0.03405
0.90	0.23549	11.71198	-0.12817	0.01366	0.80105	1.56579	0.05387	0.83283	-0.01703
0.90	0.25966	10.46122	-0.14386	0.01529	0.89910	1.11801	0.07183	0.99999	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.16248	8.15555	-0.00799	0.00981	0.09991	5.16658	0.03103	0.99994	-0.00000
0.10	0.16614	7.94762	-0.01224	0.01007	0.15305	5.06573	0.03133	0.74998	-0.01273
0.10	0.16980	7.74754	-0.01650	0.01033	0.20620	4.96488	0.03162	0.50001	-0.02546
0.10	0.17345	7.55492	-0.02075	0.01059	0.25934	4.86403	0.03191	0.25005	-0.03819
0.10	0.17711	7.36938	-0.02500	0.01086	0.31248	4.76318	0.03220	0.00008	-0.05093
0.30	0.17712	7.36934	-0.02500	0.01086	0.31250	4.76313	0.03221	0.00010	-0.05092
0.30	0.17926	7.38716	-0.02474	0.01083	0.30930	4.73900	0.03791	0.25004	-0.03819
0.30	0.18140	7.40505	-0.02449	0.01080	0.30610	4.71486	0.04361	0.49998	-0.02547
0.30	0.18355	7.42300	-0.02423	0.01078	0.30290	4.69073	0.04932	0.74993	-0.01274
0.30	0.18569	7.44102	-0.02398	0.01075	0.29970	4.66659	0.05502	0.99987	-0.00001
0.50	0.17712	7.36931	-0.02500	0.01086	0.31251	4.76313	0.03220	0.00004	-0.05093
0.50	0.18245	7.19570	-0.02874	0.01112	0.35925	4.64664	0.04057	0.25002	-0.03820
0.50	0.18779	7.02817	-0.03248	0.01138	0.40600	4.53015	0.04893	0.49999	-0.02547
0.50	0.19313	6.86641	-0.03622	0.01165	0.45274	4.41367	0.05729	0.74997	-0.01273
0.50	0.19847	6.71019	-0.03996	0.01192	0.49949	4.29718	0.06566	0.99995	-0.00000
0.70	0.17712	7.36929	-0.02500	0.01086	0.31251	4.76313	0.03220	0.00003	-0.05093
0.70	0.18562	7.00986	-0.03274	0.01141	0.40921	4.55427	0.04317	0.25001	-0.03820
0.70	0.19413	6.67610	-0.04047	0.01198	0.50590	4.34541	0.05414	0.50000	-0.02547
0.70	0.20264	6.36562	-0.04821	0.01257	0.60260	4.13655	0.06510	0.74998	-0.01273
0.70	0.21114	6.07631	-0.05594	0.01317	0.69929	3.92770	0.07607	0.99997	-0.00000
0.90	0.17712	7.36928	-0.02500	0.01086	0.31251	4.76312	0.03220	0.00002	-0.05093
0.90	0.18916	6.70034	-0.03673	0.01194	0.45916	4.42829	0.04563	0.25001	-0.03820
0.90	0.20120	6.11852	-0.04846	0.01308	0.60580	4.09347	0.05906	0.50000	-0.02546
0.90	0.21325	5.60932	-0.06020	0.01426	0.75245	3.75864	0.07249	0.74999	-0.01273
0.90	0.22529	5.16113	-0.07193	0.01550	0.89909	3.42381	0.08591	0.99998	-0.00000

CL= 0.10

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.15107	9.93978	-0.00999	0.01006	0.09991	5.38394	0.02004	0.99995	-0.00000
0.10	0.15564	9.62838	-0.01531	0.01039	0.15305	5.25787	0.02041	0.74998	-0.01592
0.10	0.16022	9.33137	-0.02062	0.01072	0.20620	5.13180	0.02077	0.50001	-0.03183
0.10	0.16479	9.04791	-0.02593	0.01105	0.25934	5.00573	0.02114	0.25004	-0.04774
0.10	0.16936	8.77716	-0.03125	0.01139	0.31249	4.87967	0.02150	0.00006	-0.06366
0.30	0.16937	8.77711	-0.03125	0.01139	0.31250	4.87962	0.02151	0.00009	-0.06366
0.30	0.17205	8.80302	-0.03093	0.01136	0.30930	4.84946	0.02864	0.25004	-0.04774
0.30	0.17473	8.82905	-0.03061	0.01133	0.30610	4.81928	0.03577	0.49999	-0.03183
0.30	0.17741	8.85519	-0.03029	0.01129	0.30290	4.78911	0.04290	0.74994	-0.01592
0.30	0.18009	8.88146	-0.02997	0.01126	0.29970	4.75894	0.05003	0.99989	-0.00001
0.50	0.16937	8.77705	-0.03125	0.01139	0.31251	4.87961	0.02151	0.00003	-0.06366
0.50	0.17604	8.52577	-0.03593	0.01173	0.35925	4.73401	0.03196	0.25001	-0.04775
0.50	0.18271	8.28511	-0.04060	0.01207	0.40600	4.58840	0.04241	0.49999	-0.03183
0.50	0.18939	8.05449	-0.04527	0.01242	0.45274	4.44279	0.05287	0.74997	-0.01592
0.50	0.19606	7.83338	-0.04995	0.01277	0.49949	4.29717	0.06332	0.99996	-0.00000

5 July 1977
BRP:JF:jep

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
CL= 0.10									
0.70	0.16937	8.77705	-0.03125	0.01139	0.31251	4.87961	0.02150	0.00002	-0.06366
0.70	0.18000	8.25891	-0.04092	0.01211	0.40921	4.61854	0.03521	0.25001	-0.04775
0.70	0.19063	7.78534	-0.05059	0.01284	0.50590	4.35747	0.04892	0.49999	-0.03183
0.70	0.20127	7.35136	-0.06026	0.01360	0.60260	4.09640	0.06263	0.74998	-0.01592
0.70	0.21190	6.95268	-0.06993	0.01438	0.69930	3.83532	0.07634	0.99997	-0.00000
0.90	0.16937	8.77703	-0.03125	0.01139	0.31251	4.87961	0.02150	0.00002	-0.06366
0.90	0.18442	7.81949	-0.04592	0.01279	0.45916	4.46108	0.03829	0.25001	-0.04775
0.90	0.19948	7.01051	-0.06058	0.01426	0.60580	4.04254	0.05507	0.50000	-0.03183
0.90	0.21453	6.32087	-0.07524	0.01582	0.75245	3.62400	0.07186	0.74999	-0.01592
0.90	0.22959	5.72821	-0.08991	0.01746	0.89910	3.20546	0.08364	0.99993	-0.00000
CL= 0.12									
0.10	0.13966	11.63344	-0.01199	0.01032	0.09991	5.60129	0.00905	0.99995	-0.00000
0.10	0.14515	11.20338	-0.01837	0.01071	0.15305	5.45000	0.00949	0.74998	-0.01910
0.10	0.15064	10.79573	-0.02474	0.01111	0.20620	5.29872	0.00993	0.50000	-0.03820
0.10	0.15613	10.41184	-0.03112	0.01153	0.25934	5.14745	0.01037	0.25003	-0.05729
0.10	0.15161	10.04715	-0.03750	0.01194	0.31249	4.99615	0.01080	0.00005	-0.07639
0.30	0.16162	10.04709	-0.03750	0.01194	0.31250	4.99611	0.01081	0.00007	-0.07639
0.30	0.16483	10.08187	-0.03712	0.01190	0.30930	4.95991	0.01936	0.25003	-0.05729
0.30	0.16805	10.11685	-0.03673	0.01186	0.30610	4.92370	0.02792	0.49999	-0.03820
0.30	0.17126	10.15198	-0.03635	0.01182	0.30290	4.88750	0.03648	0.74995	-0.01910
0.30	0.17448	10.18731	-0.03596	0.01178	0.29969	4.85128	0.04503	0.99992	-0.00001
0.50	0.16162	10.04704	-0.03750	0.01194	0.31251	4.99611	0.01081	0.00003	-0.07639
0.50	0.16963	9.71114	-0.04311	0.01236	0.35925	4.82137	0.02335	0.25001	-0.05729
0.50	0.17763	9.39180	-0.04872	0.01279	0.40600	4.64664	0.03590	0.50000	-0.03820
0.50	0.18564	9.08797	-0.05433	0.01320	0.45274	4.47191	0.04844	0.74998	-0.01910
0.50	0.19365	8.79864	-0.05994	0.01364	0.49949	4.29717	0.06099	0.99997	-0.00000
0.70	0.16162	10.04702	-0.03750	0.01194	0.31251	4.99610	0.01081	0.00002	-0.07639
0.70	0.17438	9.35720	-0.04910	0.01282	0.40920	4.68282	0.02726	0.25001	-0.05730
0.70	0.18714	8.73605	-0.06071	0.01374	0.50590	4.36952	0.04371	0.50000	-0.03820
0.70	0.19990	8.17476	-0.07231	0.01468	0.60260	4.05623	0.06015	0.74999	-0.01910
0.70	0.21266	7.66589	-0.08392	0.01565	0.69930	3.74294	0.07660	0.99998	-0.00000
0.90	0.16162	10.04700	-0.03750	0.01194	0.31251	4.99610	0.01081	0.00001	-0.07639
0.90	0.17968	8.78055	-0.05510	0.01367	0.45916	4.49386	0.03095	0.25001	-0.05730
0.90	0.19775	7.73930	-0.07270	0.01551	0.60580	3.99160	0.05109	0.50000	-0.03820
0.90	0.21582	6.87285	-0.09029	0.01746	0.75245	3.48936	0.07123	0.74999	-0.01910
0.90	0.23388	6.14416	-0.10789	0.01953	0.89910	2.98711	0.09137	0.99998	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.14

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.15255	11.28685	-0.04222	0.01240	0.30157	5.14891	0.00000	0.05141	-0.08454
0.10	0.15288	11.26344	-0.04260	0.01243	0.30430	5.13985	0.00003	0.03857	-0.08569
0.10	0.15321	11.24008	-0.04298	0.01246	0.30703	5.13078	0.00005	0.02573	-0.08683
0.10	0.15353	11.21681	-0.04337	0.01248	0.30976	5.12171	0.00008	0.01289	-0.08798
0.10	0.15386	11.19360	-0.04375	0.01251	0.31249	5.11265	0.00011	0.00004	-0.08912
0.30	0.15387	11.19353	-0.04375	0.01251	0.31250	5.11261	0.00011	0.00006	-0.08912
0.30	0.15762	11.23773	-0.04330	0.01246	0.30930	5.07036	0.01009	0.25003	-0.06684
0.30	0.16137	11.28220	-0.04285	0.01241	0.30610	5.02812	0.02007	0.49999	-0.04456
0.30	0.16512	11.32690	-0.04241	0.01236	0.30290	4.98588	0.03006	0.74996	-0.02229
0.30	0.16887	11.37191	-0.04196	0.01231	0.29969	4.94363	0.04004	0.99993	-0.00001
0.50	0.15387	11.19348	-0.04375	0.01251	0.31250	5.11260	0.00011	0.00002	-0.08912
0.50	0.16321	10.76832	-0.05030	0.01300	0.35925	4.90874	0.01474	0.25001	-0.06684
0.50	0.17256	10.36695	-0.05684	0.01350	0.40600	4.70488	0.02938	0.50000	-0.04456
0.50	0.18190	9.98759	-0.06338	0.01402	0.45274	4.50102	0.04401	0.74998	-0.02228
0.50	0.19124	9.62868	-0.06993	0.01454	0.49949	4.29716	0.05865	0.99997	-0.00000
0.70	0.15387	11.19347	-0.04375	0.01251	0.31251	5.11259	0.00011	0.00001	-0.08913
0.70	0.16875	10.32362	-0.05729	0.01356	0.40920	4.74709	0.01930	0.25001	-0.06684
0.70	0.18364	9.55135	-0.07083	0.01466	0.50590	4.38158	0.03849	0.50000	-0.04456
0.70	0.19853	8.86261	-0.08436	0.01580	0.60260	4.01607	0.05768	0.74999	-0.02228
0.70	0.21342	8.24576	-0.09790	0.01698	0.69930	3.65056	0.07687	0.99998	-0.00000
0.90	0.15387	11.19345	-0.04375	0.01251	0.31251	5.11259	0.00011	0.00001	-0.08913
0.90	0.17494	9.60633	-0.06428	0.01457	0.45915	4.52663	0.02360	0.25000	-0.06684
0.90	0.19602	8.33432	-0.08481	0.01680	0.60580	3.94068	0.04710	0.50000	-0.04456
0.90	0.21710	7.29918	-0.10534	0.01918	0.75245	3.35472	0.07060	0.74999	-0.02228
0.90	0.23818	6.44558	-0.12587	0.02172	0.89910	2.76876	0.09410	0.99999	-0.00000

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.30	0.15010	12.27909	-0.04952	0.01303	0.30953	5.18427	0.00000	0.23216	-0.07821
0.30	0.15339	12.32075	-0.04913	0.01299	0.30707	5.14720	0.00876	0.42410	-0.05866
0.30	0.15668	12.36262	-0.04874	0.01294	0.30461	5.11013	0.01752	0.61605	-0.03911
0.30	0.15998	12.40472	-0.04834	0.01290	0.30215	5.07306	0.02628	0.80799	-0.01956
0.30	0.16327	12.44703	-0.04795	0.01285	0.29969	5.03598	0.03505	0.99994	-0.00001
0.50	0.15288	11.89742	-0.05474	0.01345	0.34211	5.08153	0.00000	0.15835	-0.08573
0.50	0.16187	11.47736	-0.06103	0.01394	0.38146	4.88543	0.01408	0.36876	-0.06430
0.50	0.17086	11.07916	-0.06733	0.01444	0.42080	4.68935	0.02816	0.57916	-0.04287
0.50	0.17985	10.70132	-0.07362	0.01495	0.46014	4.49325	0.04224	0.78957	-0.02143
0.50	0.18884	10.34249	-0.07992	0.01547	0.49949	4.29716	0.05632	0.99997	-0.00000
0.70	0.15433	11.70170	-0.05747	0.01367	0.35921	5.02732	0.00000	0.12076	-0.08956
0.70	0.16929	10.82576	-0.07108	0.01478	0.44423	4.66004	0.01929	0.34057	-0.06717
0.70	0.18425	10.04461	-0.08468	0.01593	0.52926	4.29276	0.03857	0.56037	-0.04478
0.70	0.19921	9.34504	-0.09828	0.01712	0.61428	3.92547	0.05785	0.78018	-0.02239
0.70	0.21417	8.71611	-0.11189	0.01836	0.69930	3.55819	0.07714	0.99998	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.150

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.90	0.15562	11.41529	-0.05926	0.01402	0.37036	4.96491	0.00000	0.09863	-0.09181
0.90	0.17733	9.83561	-0.08041	0.01627	0.50254	4.36128	0.02421	0.32397	-0.06886
0.90	0.19905	8.56250	-0.10156	0.01869	0.63473	3.75766	0.04841	0.54931	-0.04591
0.90	0.22076	7.52149	-0.12271	0.02127	0.76691	3.15404	0.07262	0.77465	-0.02295
0.90	0.24247	6.65938	-0.14386	0.02403	0.89910	2.55042	0.09683	0.99999	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.08

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.17389	4.70656	-0.00799	0.01700	0.09992	6.59897	0.05603	0.99992	-0.00000
0.10	0.17663	4.61497	-0.01224	0.01733	0.15306	6.49812	0.05633	0.74996	-0.01273
0.10	0.17938	4.52605	-0.01650	0.01768	0.20620	6.39728	0.05662	0.50001	-0.02546
0.10	0.18212	4.43966	-0.02075	0.01802	0.25934	6.29643	0.05691	0.25006	-0.03819
0.10	0.18486	4.35572	-0.02500	0.01837	0.31248	6.19559	0.05720	0.00010	-0.05092
0.30	0.18487	4.35569	-0.02500	0.01837	0.31250	6.19552	0.05721	0.00015	-0.05092
0.30	0.18647	4.36380	-0.02474	0.01833	0.30930	6.17139	0.06291	0.25006	-0.03819
0.30	0.18808	4.37191	-0.02449	0.01830	0.30610	6.14726	0.06861	0.49998	-0.02547
0.30	0.18969	4.38005	-0.02423	0.01826	0.30290	6.12312	0.07432	0.74991	-0.01274
0.30	0.19130	4.38821	-0.02398	0.01823	0.29970	6.09899	0.08002	0.99984	-0.00001
0.50	0.18487	4.35567	-0.02500	0.01837	0.31251	6.19552	0.05721	0.00006	-0.05093
0.50	0.18887	4.27647	-0.02874	0.01871	0.35925	6.07903	0.06557	0.25003	-0.03820
0.50	0.19287	4.19941	-0.03248	0.01905	0.40600	5.96255	0.07393	0.49999	-0.02547
0.50	0.19688	4.12441	-0.03622	0.01940	0.45274	5.84607	0.08229	0.74996	-0.01273
0.50	0.20088	4.05140	-0.03996	0.01975	0.49948	5.72958	0.09066	0.99993	-0.00000
0.70	0.18487	4.35567	-0.02500	0.01837	0.31251	6.19551	0.05720	0.00004	-0.05093
0.70	0.19125	4.19095	-0.03274	0.01909	0.40921	5.98666	0.06817	0.25001	-0.03820
0.70	0.19763	4.03539	-0.04047	0.01982	0.50590	5.77780	0.07914	0.49999	-0.02547
0.70	0.20401	3.88833	-0.04821	0.02057	0.60259	5.56896	0.09010	0.74997	-0.01273
0.70	0.21039	3.74917	-0.05594	0.02134	0.69929	5.36010	0.10107	0.99995	-0.00000
0.90	0.18487	4.35566	-0.02500	0.01837	0.31252	6.19551	0.05720	0.00003	-0.05093
0.90	0.19390	4.04677	-0.03673	0.01977	0.45916	5.86068	0.07063	0.25001	-0.03820
0.90	0.20293	3.76960	-0.04846	0.02122	0.60580	5.52586	0.08406	0.50000	-0.02546
0.90	0.21197	3.51997	-0.06020	0.02273	0.75245	5.19104	0.09748	0.74998	-0.01273
0.90	0.22100	3.29433	-0.07193	0.02428	0.89909	4.85621	0.11091	0.99997	-0.00000

CL= 0.10

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.10	0.16533	5.77104	-0.00999	0.01733	0.09991	6.81632	0.04504	0.99993	-0.00000
0.10	0.16876	5.63250	-0.01531	0.01775	0.15305	6.69026	0.04541	0.74997	-0.01592
0.10	0.17219	5.49889	-0.02062	0.01819	0.20620	6.56420	0.04577	0.50001	-0.03183
0.10	0.17562	5.36998	-0.02593	0.01862	0.25934	6.43814	0.04614	0.25005	-0.04774
0.10	0.17905	5.24554	-0.03125	0.01906	0.31249	6.31207	0.04650	0.00008	-0.06366
0.30	0.17905	5.24551	-0.03125	0.01906	0.31250	6.31202	0.04651	0.00011	-0.06365
0.30	0.18106	5.25748	-0.03093	0.01902	0.30930	6.28185	0.05364	0.25004	-0.04774
0.30	0.18307	5.26949	-0.03061	0.01898	0.30610	6.25168	0.06077	0.49998	-0.03183
0.30	0.18508	5.28153	-0.03029	0.01893	0.30290	6.22151	0.06790	0.74991	-0.01592
0.30	0.18709	5.29362	-0.02997	0.01889	0.29970	6.19134	0.07503	0.99986	-0.00001
0.50	0.17905	5.24549	-0.03125	0.01906	0.31251	6.31201	0.04651	0.00005	-0.06366
0.50	0.18406	5.12881	-0.03593	0.01950	0.35925	6.16640	0.05696	0.25002	-0.04775
0.50	0.18906	5.01599	-0.04060	0.01994	0.40600	6.02079	0.06741	0.49999	-0.03183
0.50	0.19407	4.90685	-0.04527	0.02038	0.45274	5.87519	0.07787	0.74996	-0.01592
0.50	0.19908	4.80123	-0.04995	0.02083	0.49948	5.72958	0.08832	0.99995	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
CL= 0.10									
0.70	0.17905	5.24548	-0.03125	0.01906	0.31251	6.31201	0.04651	0.00003	-0.06366
0.70	0.18703	5.00365	-0.04092	0.01999	0.40921	6.05093	0.06021	0.25001	-0.04775
0.70	0.19500	4.77816	-0.05059	0.02093	0.50590	5.78986	0.07392	0.49999	-0.03183
0.70	0.20298	4.56758	-0.06026	0.02189	0.60260	5.52879	0.08763	0.74998	-0.01592
0.70	0.21095	4.37061	-0.06993	0.02288	0.69929	5.26772	0.10134	0.99997	-0.00000
0.90	0.17905	5.24547	-0.03125	0.01906	0.31251	6.31200	0.04651	0.00002	-0.06366
0.90	0.19034	4.79456	-0.04592	0.02086	0.45916	5.89347	0.06329	0.25001	-0.04775
0.90	0.20164	4.39939	-0.06058	0.02273	0.60580	5.47493	0.08007	0.50000	-0.03183
0.90	0.21293	4.05114	-0.07524	0.02468	0.75245	5.05640	0.09686	0.74999	-0.01592
0.90	0.22422	3.74266	-0.08991	0.02672	0.89909	4.63787	0.11364	0.99997	-0.00000
CL= 0.12									
0.10	0.15678	6.79447	-0.01199	0.01766	0.09991	7.03368	0.03405	0.99994	-0.00000
0.10	0.16089	6.60126	-0.01837	0.01818	0.15305	6.88240	0.03449	0.74997	-0.01910
0.10	0.16501	6.41616	-0.02474	0.01870	0.20620	6.73112	0.03493	0.50000	-0.03820
0.10	0.16912	6.23875	-0.03112	0.01923	0.25934	6.57985	0.03537	0.25004	-0.05729
0.10	0.17324	6.06859	-0.03750	0.01977	0.31249	6.42856	0.03580	0.00006	-0.07639
0.30	0.17324	6.06855	-0.03750	0.01977	0.31250	6.42851	0.03581	0.00010	-0.07639
0.30	0.17565	6.08487	-0.03712	0.01972	0.30930	6.39231	0.04436	0.25004	-0.05729
0.30	0.17806	6.10125	-0.03673	0.01967	0.30610	6.35610	0.05292	0.49999	-0.03820
0.30	0.18048	6.11770	-0.03635	0.01962	0.30290	6.31990	0.06148	0.74993	-0.01910
0.30	0.18289	6.13422	-0.03596	0.01956	0.29970	6.28369	0.07003	0.99989	-0.00001
0.50	0.17324	6.06852	-0.03750	0.01977	0.31251	6.42849	0.03581	0.00004	-0.07639
0.50	0.17925	5.90995	-0.04311	0.02030	0.35925	6.25377	0.04835	0.25002	-0.05729
0.50	0.18525	5.75752	-0.04872	0.02084	0.40600	6.07904	0.06090	0.49999	-0.03820
0.50	0.19126	5.61091	-0.05433	0.02139	0.45274	5.90431	0.07344	0.74997	-0.01910
0.50	0.19727	5.46983	-0.05994	0.02194	0.49949	5.72957	0.08599	0.99995	-0.00000
0.70	0.17324	6.06851	-0.03750	0.01977	0.31251	6.42849	0.03581	0.00002	-0.07639
0.70	0.18281	5.74089	-0.04910	0.02090	0.40921	6.11521	0.05226	0.25001	-0.05729
0.70	0.19238	5.43911	-0.06071	0.02206	0.50590	5.80193	0.06870	0.50000	-0.03820
0.70	0.20195	5.16051	-0.07231	0.02325	0.60260	5.48864	0.08515	0.74998	-0.01910
0.70	0.21152	4.90278	-0.08392	0.02448	0.69929	5.17534	0.10160	0.99997	-0.00000
0.90	0.17324	6.06850	-0.03750	0.01977	0.31251	6.42849	0.03581	0.00002	-0.07639
0.90	0.18679	5.46095	-0.05510	0.02197	0.45916	5.92625	0.05595	0.25001	-0.05730
0.90	0.20034	4.94027	-0.07270	0.02429	0.60580	5.42401	0.07609	0.50000	-0.03820
0.90	0.21389	4.49066	-0.09029	0.02672	0.75245	4.92176	0.09623	0.74999	-0.01910
0.90	0.22744	4.09974	-0.10789	0.02927	0.89910	4.41951	0.11637	0.99998	-0.00000

THIRD FOIL DESIGN METHOD WITH X0= 0.100

K= 0.000 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
CL= 0.14									
0.10	0.14822	7.77861	-0.01399	0.01800	0.09991	7.25103	0.02306	0.99996	-0.00000
0.10	0.15302	7.52380	-0.02143	0.01861	0.15305	7.07454	0.02357	0.74998	-0.02228
0.10	0.15782	7.28131	-0.02887	0.01923	0.20620	6.89805	0.02408	0.50000	-0.04456
0.10	0.16262	7.05037	-0.03631	0.01986	0.25934	6.72155	0.02459	0.25003	-0.06684
0.10	0.16743	6.83024	-0.04375	0.02050	0.31249	6.54506	0.02511	0.00006	-0.08912
0.30	0.16743	6.83019	-0.04375	0.02050	0.31250	6.54500	0.02511	0.00008	-0.08912
0.30	0.17024	6.85124	-0.04330	0.02043	0.30930	6.50276	0.03509	0.25003	-0.06684
0.30	0.17306	6.87239	-0.04285	0.02037	0.30610	6.46051	0.04507	0.49999	-0.04456
0.30	0.17587	6.89363	-0.04241	0.02031	0.30290	6.41828	0.05506	0.74994	-0.02229
0.30	0.17868	6.91499	-0.04196	0.02025	0.29970	6.37603	0.06504	0.99990	-0.00001
0.50	0.16743	6.83016	-0.04375	0.02050	0.31251	6.54499	0.02511	0.00003	-0.08912
0.50	0.17444	6.62623	-0.05030	0.02113	0.35925	6.34113	0.03974	0.25002	-0.06684
0.50	0.18144	6.43131	-0.05684	0.02177	0.40600	6.13728	0.05438	0.50000	-0.04456
0.50	0.18845	6.24486	-0.06338	0.02242	0.45274	5.93342	0.06901	0.74998	-0.02228
0.50	0.19546	6.06640	-0.06993	0.02308	0.49949	5.72956	0.08365	0.99996	-0.00000
0.70	0.16743	6.83015	-0.04375	0.02050	0.31251	6.54499	0.02511	0.00002	-0.08912
0.70	0.17859	6.41012	-0.05729	0.02184	0.40921	6.17948	0.04430	0.25001	-0.06684
0.70	0.18976	6.02768	-0.07083	0.02323	0.50590	5.81398	0.06349	0.50000	-0.04456
0.70	0.20092	5.67846	-0.08436	0.02465	0.60260	5.44848	0.08268	0.74998	-0.02228
0.70	0.21209	5.35874	-0.09790	0.02613	0.69930	5.08297	0.10187	0.99998	-0.00000
0.90	0.16743	6.83014	-0.04375	0.02050	0.31251	6.54498	0.02511	0.00001	-0.08913
0.90	0.18324	6.05521	-0.06428	0.02312	0.45915	5.95903	0.04860	0.25001	-0.06684
0.90	0.19905	5.40505	-0.08481	0.02590	0.60580	5.37308	0.07210	0.50000	-0.04456
0.90	0.21485	4.85425	-0.10534	0.02884	0.75245	4.78712	0.09560	0.74999	-0.02228
0.90	0.23066	4.38355	-0.12587	0.03194	0.89910	4.20117	0.11910	0.99998	-0.00000
CL= 0.16									
0.10	0.13966	8.72507	-0.01599	0.01834	0.09991	7.46838	0.01207	0.99995	-0.00000
0.10	0.14515	8.40253	-0.02449	0.01904	0.15305	7.26666	0.01265	0.74998	-0.02547
0.10	0.15064	8.09755	-0.03299	0.01976	0.20620	7.06497	0.01324	0.50000	-0.05093
0.10	0.15613	7.80888	-0.04149	0.02049	0.25934	6.86326	0.01382	0.25003	-0.07639
0.10	0.16161	7.53536	-0.05000	0.02123	0.31249	6.66155	0.01441	0.00005	-0.10185
0.30	0.16162	7.53532	-0.05000	0.02123	0.31250	6.66149	0.01441	0.00007	-0.10185
0.30	0.16483	7.56140	-0.04949	0.02116	0.30930	6.61321	0.02582	0.25003	-0.07639
0.30	0.16805	7.58763	-0.04898	0.02109	0.30610	6.56493	0.03723	0.49999	-0.05093
0.30	0.17126	7.61398	-0.04846	0.02101	0.30290	6.51666	0.04864	0.74995	-0.02547
0.30	0.17448	7.64048	-0.04795	0.02094	0.29970	6.46838	0.06004	0.99992	-0.00001
0.50	0.16162	7.53528	-0.05000	0.02123	0.31251	6.66148	0.01441	0.00003	-0.10186
0.50	0.16963	7.28335	-0.05748	0.02197	0.35925	6.42850	0.03113	0.25001	-0.07639
0.50	0.17763	7.04385	-0.06496	0.02271	0.40600	6.19552	0.04786	0.50000	-0.05093
0.50	0.18564	6.81597	-0.07244	0.02347	0.45274	5.96254	0.06459	0.74998	-0.02547
0.50	0.19365	6.59898	-0.07992	0.02425	0.49949	5.72956	0.08131	0.99997	-0.00000

THIRD FOIL DESIGN METHOD WITH XO= 0.100

K= 0.000 T= 0.200

ELLIPTICAL PRESSURE DISTRIBUTIONS

CL= 0.16

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.70	0.16162	7.53527	-0.05000	0.02123	0.31251	6.66147	0.01441	0.00002	-0.10186
0.70	0.17438	7.01790	-0.06547	0.02280	0.40920	6.24376	0.03634	0.25001	-0.07639
0.70	0.18714	6.55204	-0.08094	0.02442	0.50590	5.82604	0.05827	0.50000	-0.05093
0.70	0.19990	6.13107	-0.09642	0.02610	0.60260	5.40831	0.08021	0.74999	-0.02547
0.70	0.21266	5.74941	-0.11189	0.02783	0.69930	4.99059	0.10214	0.99998	-0.00000
0.90	0.16162	7.53525	-0.05000	0.02123	0.31251	6.66147	0.01441	0.00001	-0.10186
0.90	0.17968	6.58541	-0.07346	0.02430	0.45916	5.99180	0.04126	0.25001	-0.07639
0.90	0.19775	5.80447	-0.09693	0.02756	0.60580	5.32215	0.06812	0.50000	-0.05093
0.90	0.21582	5.15463	-0.12039	0.03104	0.75245	4.65248	0.09497	0.74999	-0.02547
0.90	0.23388	4.60811	-0.14386	0.03472	0.89910	3.98282	0.12183	0.99998	-0.00000

Third Foil Design Method with X0=0.100

Three Term Pressure Distributions

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.75	0.15432	18.14859	-0.04721	0.00661	0.39342	3.30530	0.00000	0.22743	-0.05902
0.75	0.20850	13.95578	-0.08020	0.00860	0.66830	2.42737	0.04823	1.00001	0.00000

K = 0.000

T = 0.100

CL = 0.12

Third Foil Design Method with X0=0.100

Reversed Three Term Pressure Distributions

S	MU	L/D	CM	CD	XBAR	ALPHA	YC(1)	M	ACAP
0.25	0.14778	19.41006	-0.03990	0.00618	0.33248	3.46331	0.00000	0.38398	-0.04706
0.25	0.16289	18.88766	-0.04375	0.00635	0.36454	3.30220	0.02278	1.00000	0.00000

K = 0.000

T = 0.100

CL = 0.12

5 July 1977
BRP:JF:jep

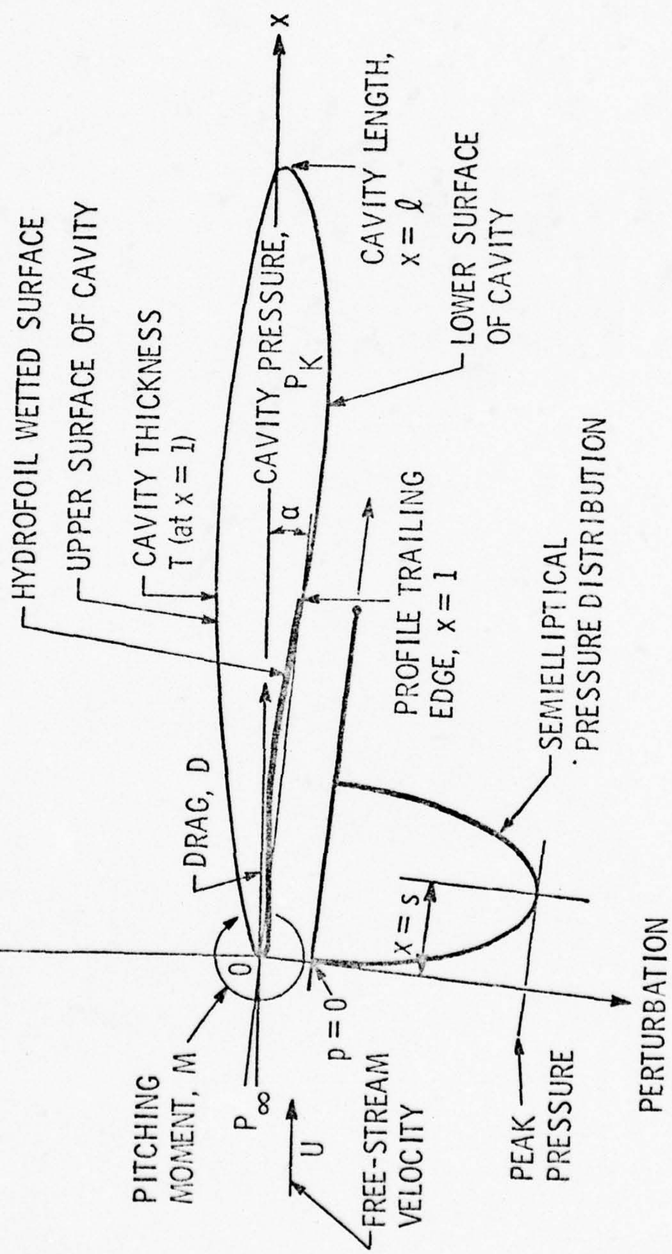


Figure 1 - Schematic Diagram of Two-Dimensional Flow Geometry and Prescribed Pressure Distribution

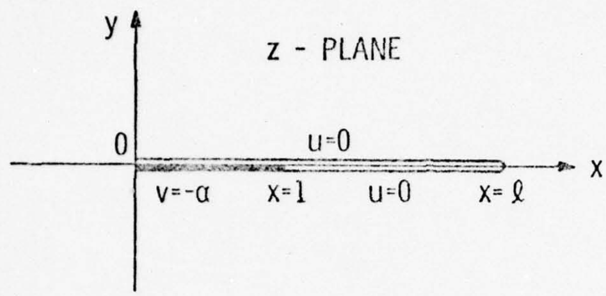


Figure 2 - Mathematical Representation of the Hydrofoil and Cavity in the Complex z-Plane

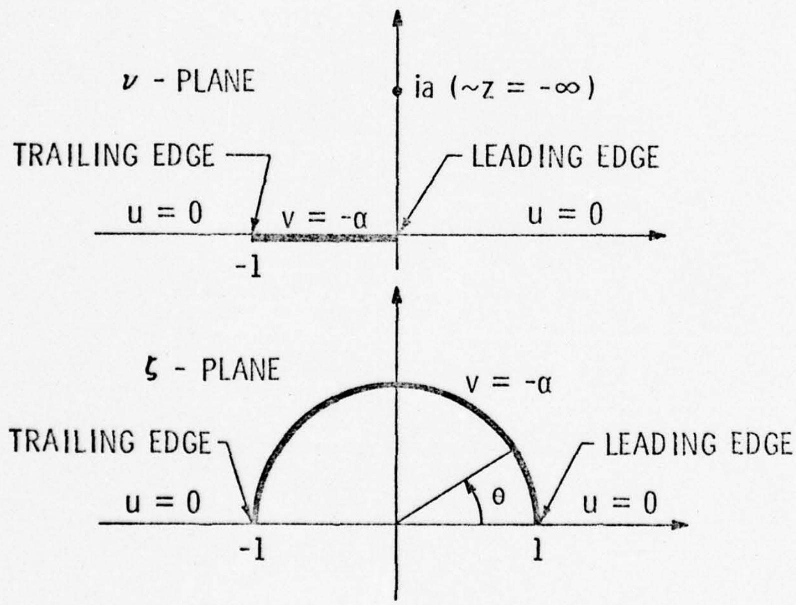


Figure 3 - The Hydrofoil and its Cavity in the ν and ζ-Planes After the Application of Conformal Mappings

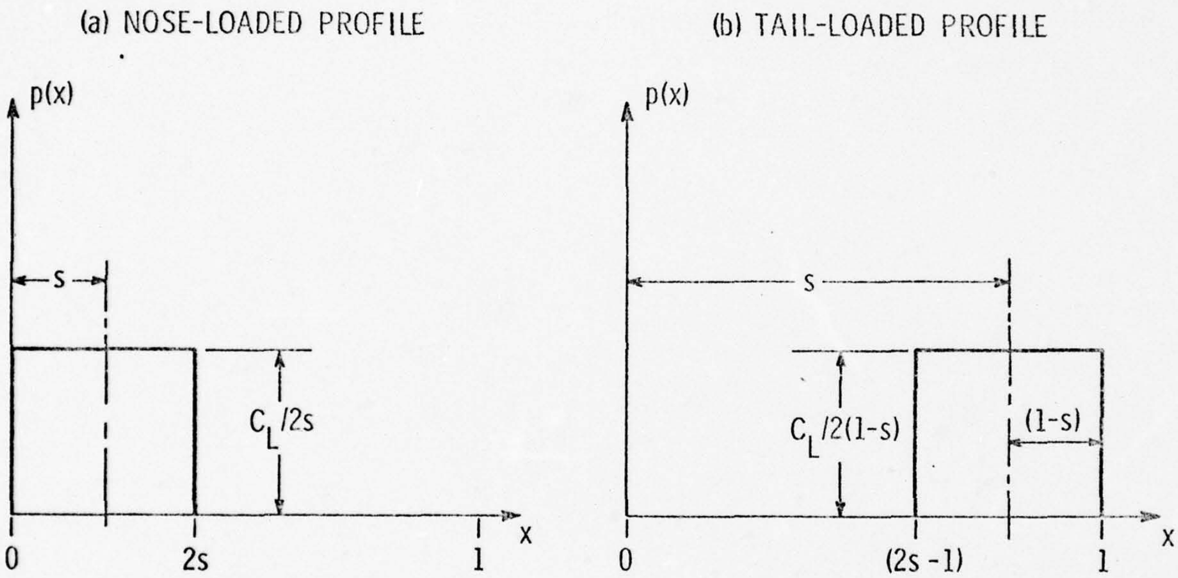


Figure 4 - Parametric Representations of Rectangular Pressure Distributions for Nose-Loaded (a) and Tail-Loaded (b) Hydrofoil Sections

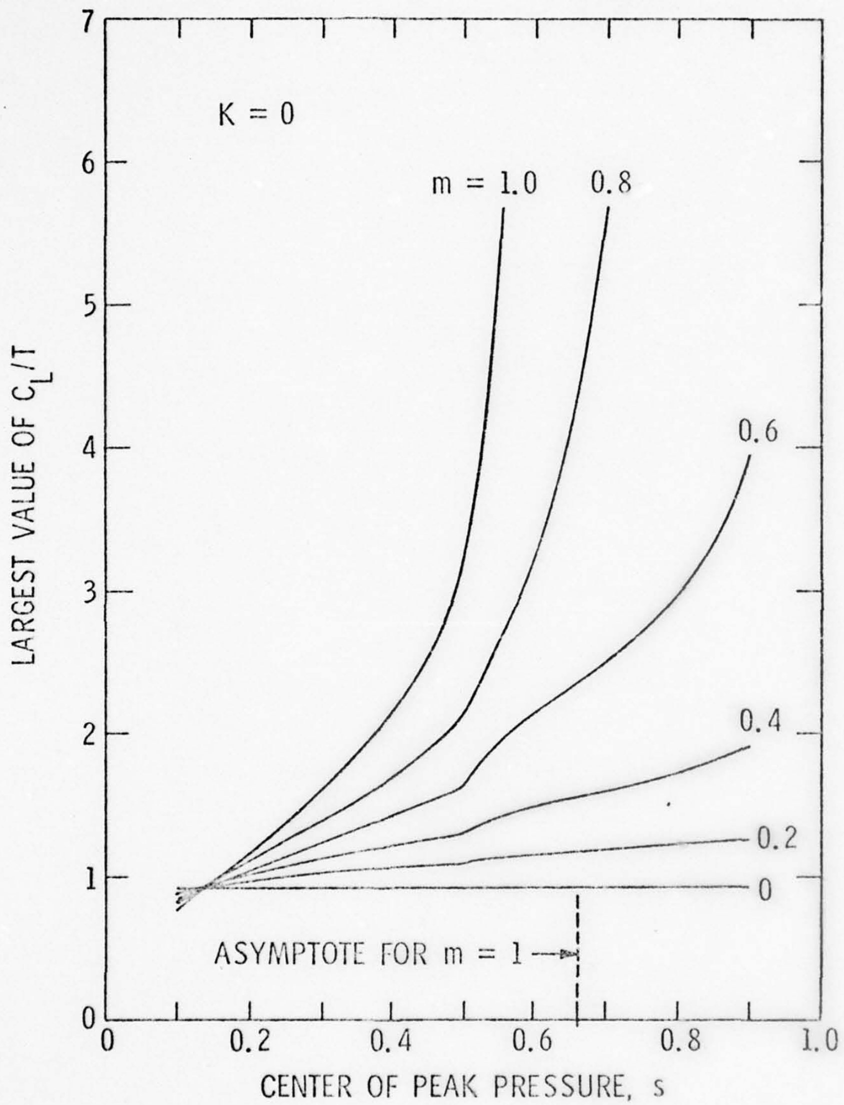


Figure 5 - Limiting Values of C_L/T for Rectangular Pressure Distributions at Zero Cavitation Number

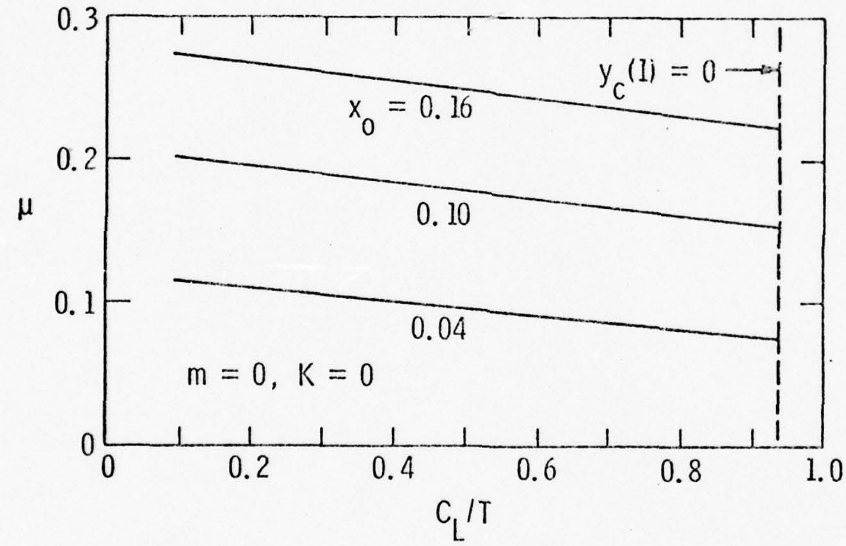


Figure 6 - Permissible Values of μ at Zero Cavitation Number and Lift Parameter m for Rectangular Pressure Distributions and Three Nose Control Points, x_o

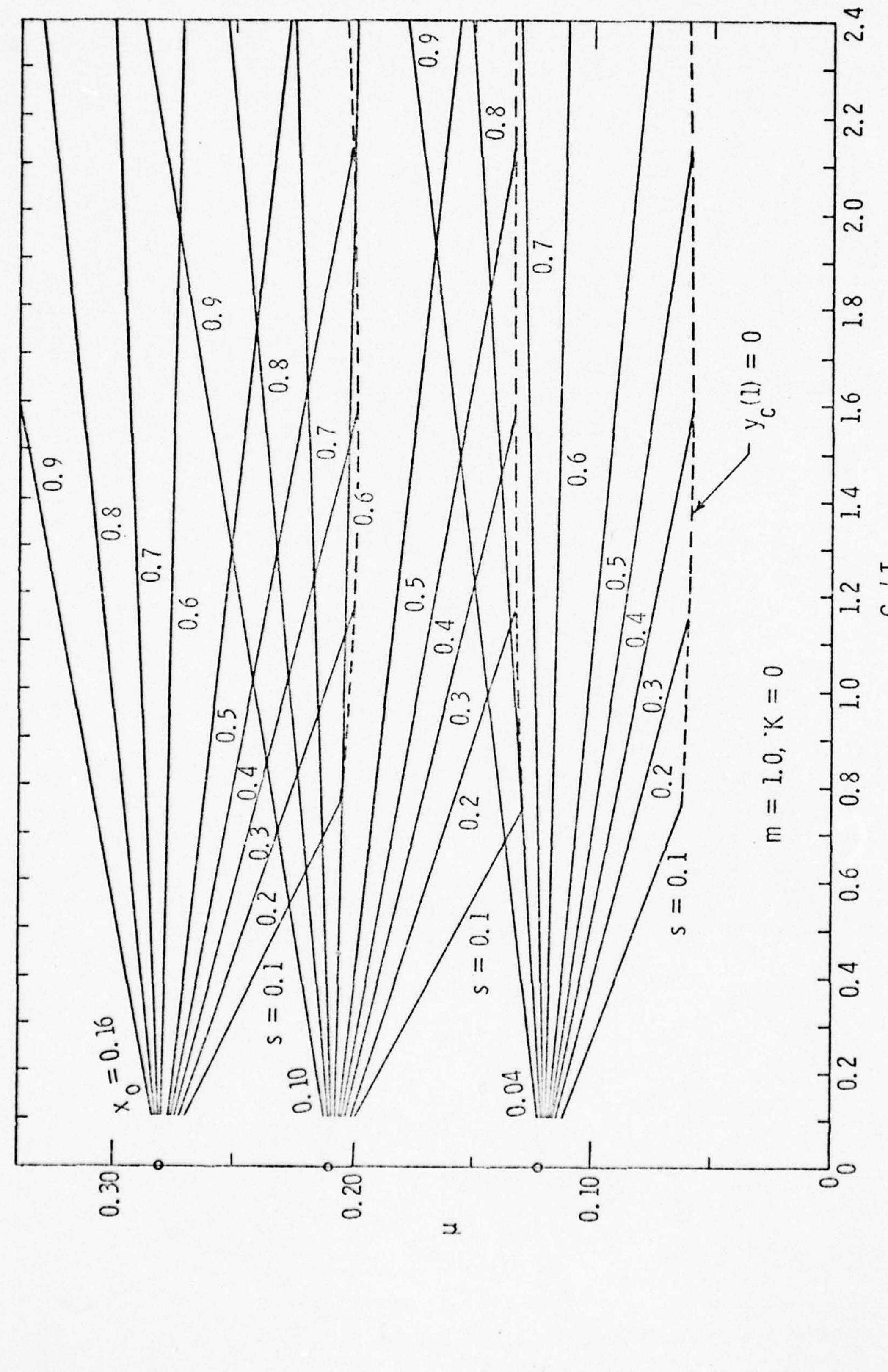
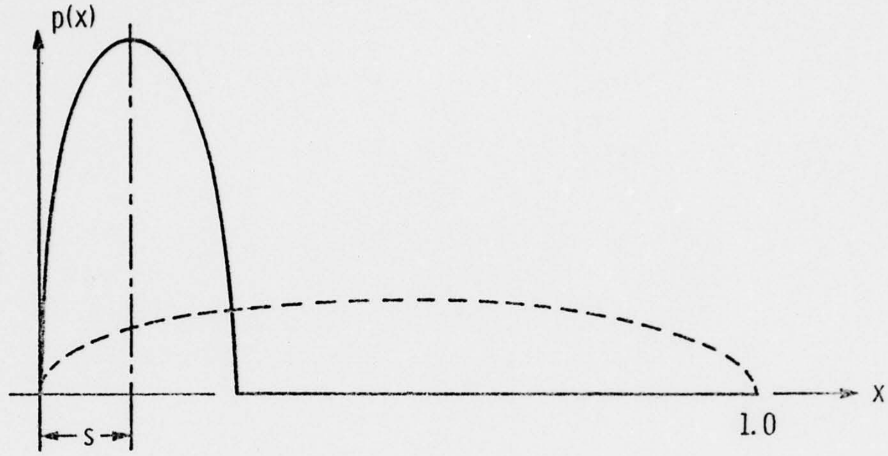


Figure 7 - Permissible Values of μ at Shockless Entry for Rectangular Pressure Distributions at Zero Cavitation Number



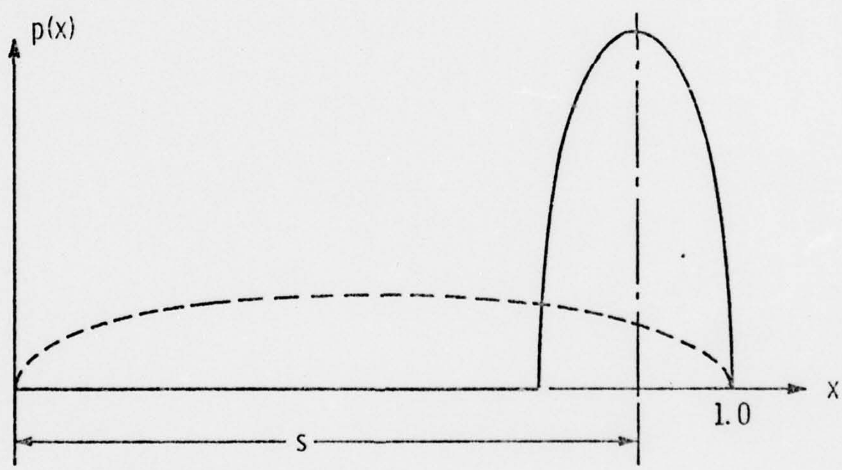


Figure 8 - Semi-Elliptical Pressure Distributions for Nose and Tail Loadings

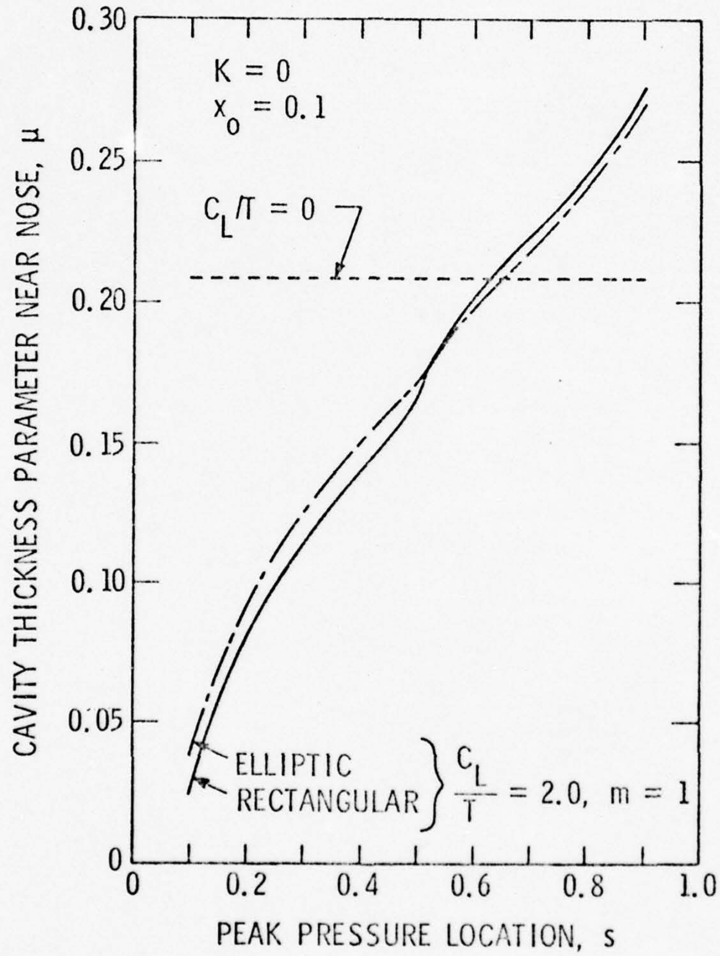


Figure 9 - Effect of Pressure Distribution Shape on Permissible Values of μ at the Ideal Attack Angle

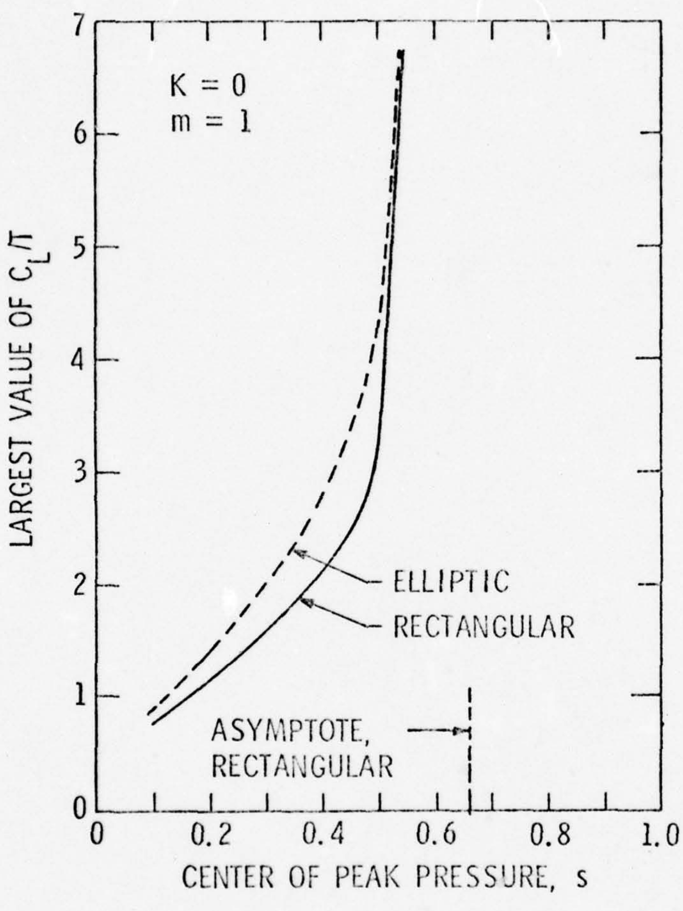


Figure 10 - Limiting Values of C_L/T as Affected by Pressure Distribution Shape at the Ideal Attack Angle

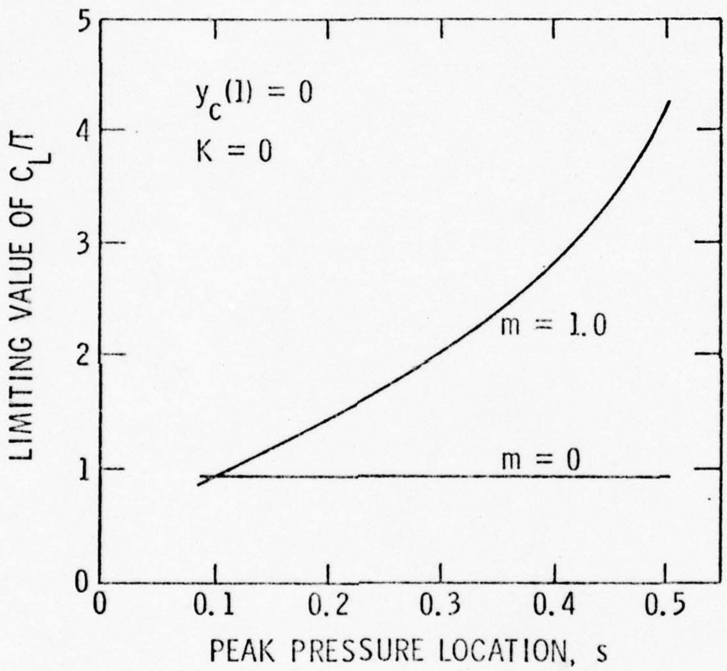


Figure 11 - Limiting Value of C_L/T for Semi-Elliptical Pressure Distributions

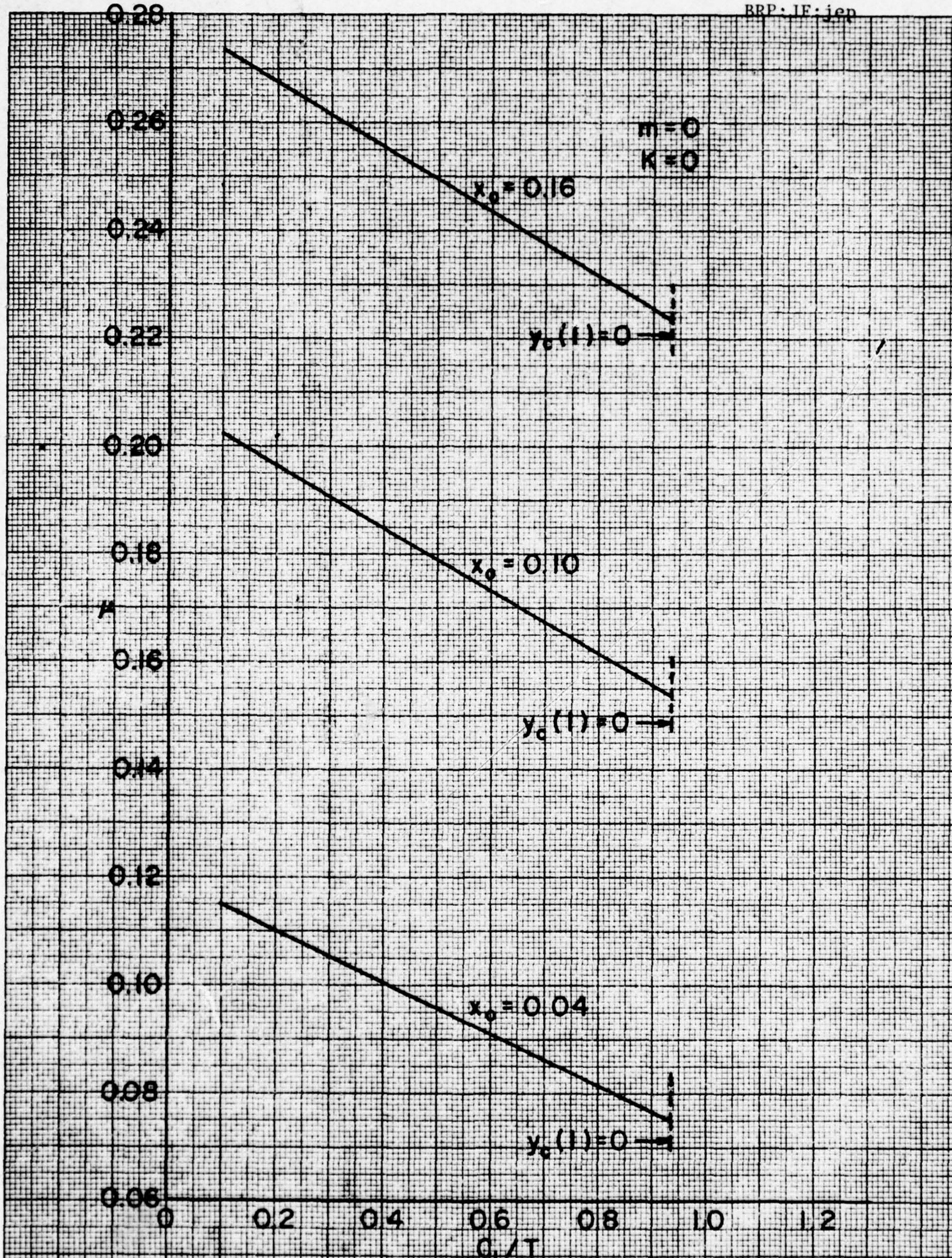


Figure 12 - Permissible Values of μ for Semi-Elliptical Pressure Distributions at K=0 and m=0

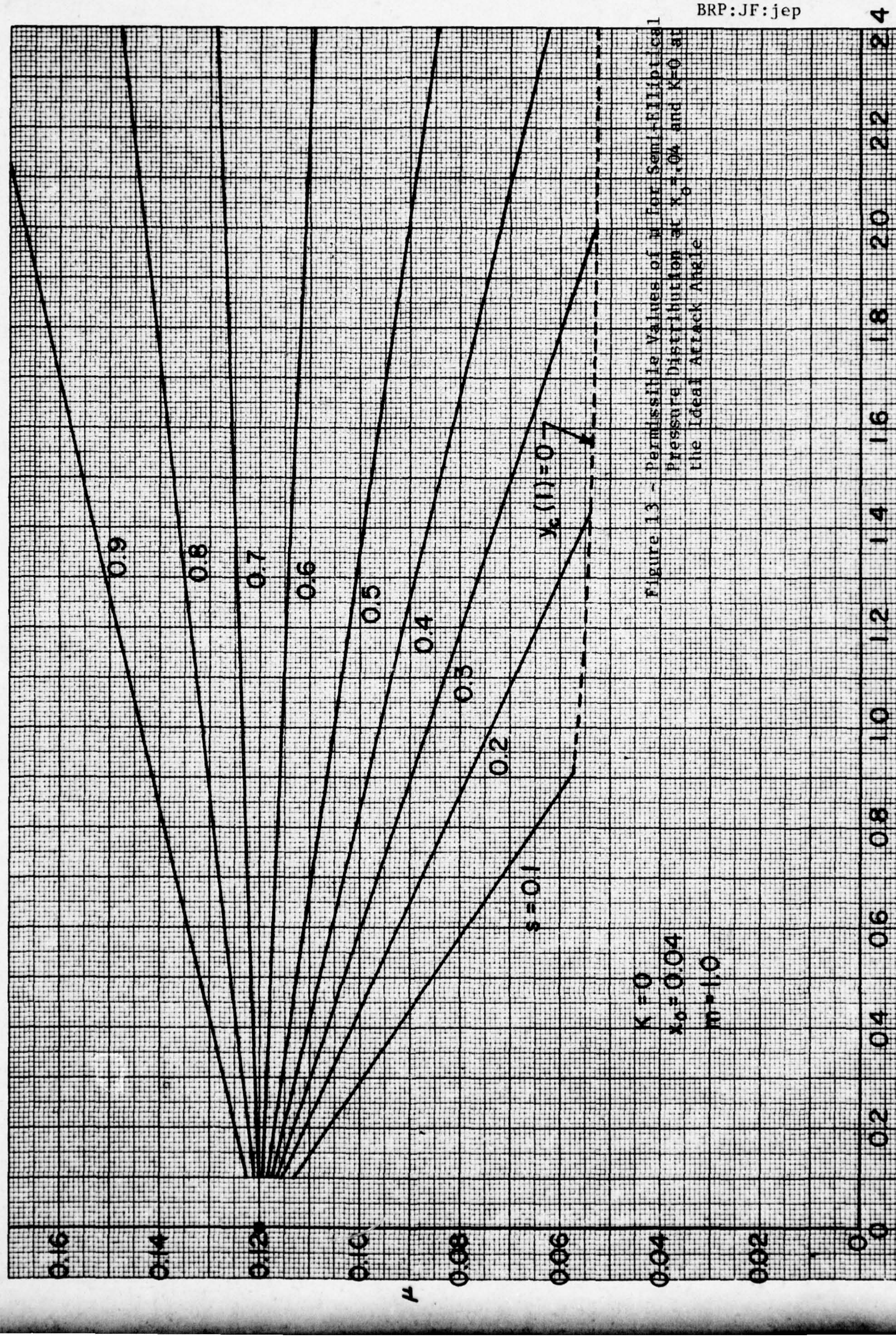


Figure 13 - Permissible Values of μ for Semi-Elliptical Pressure Distribution at $x_o = .04$ and K=0 at the Ideal Attack Angle

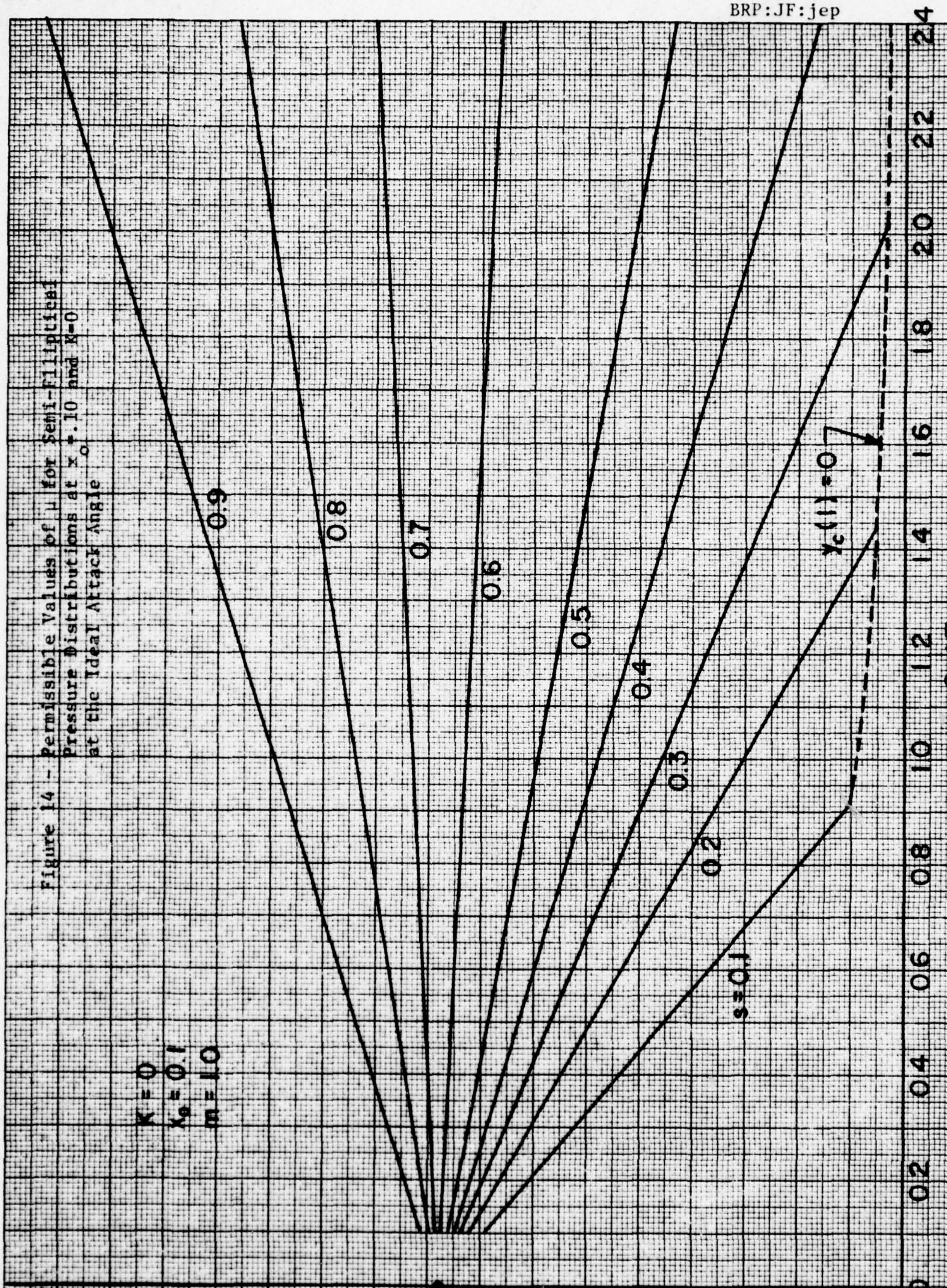


Figure 14 - Permissible Values of μ for Semi-Elliptical Pressure Distributions at x_o = .10 and K=0 at the Ideal Attack Angle

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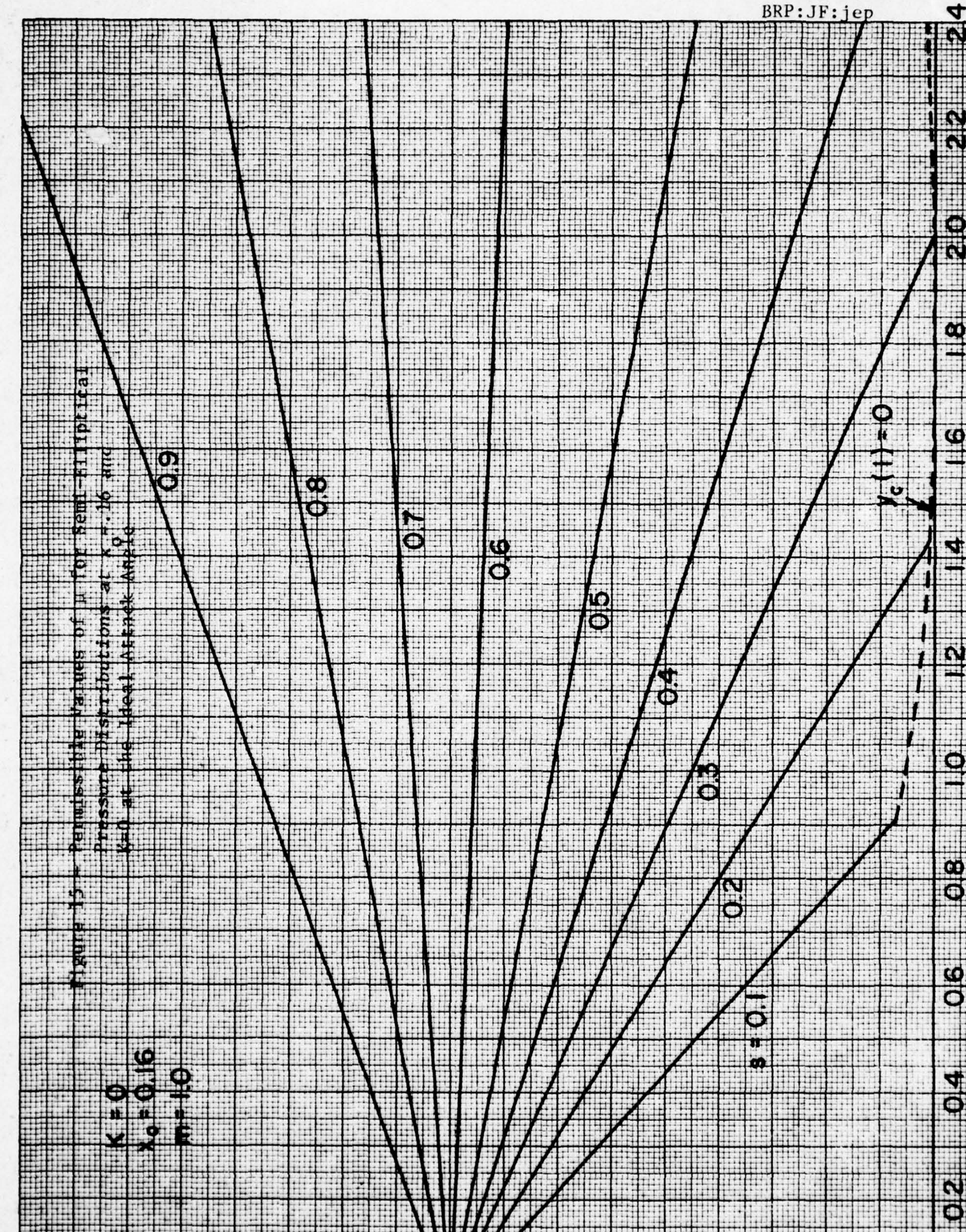


Figure 15 - Permissible Values of μ for Semi-Elliptical Pressure Distributions at x_o = .16 and K=0 at the Ideal Attack Angle

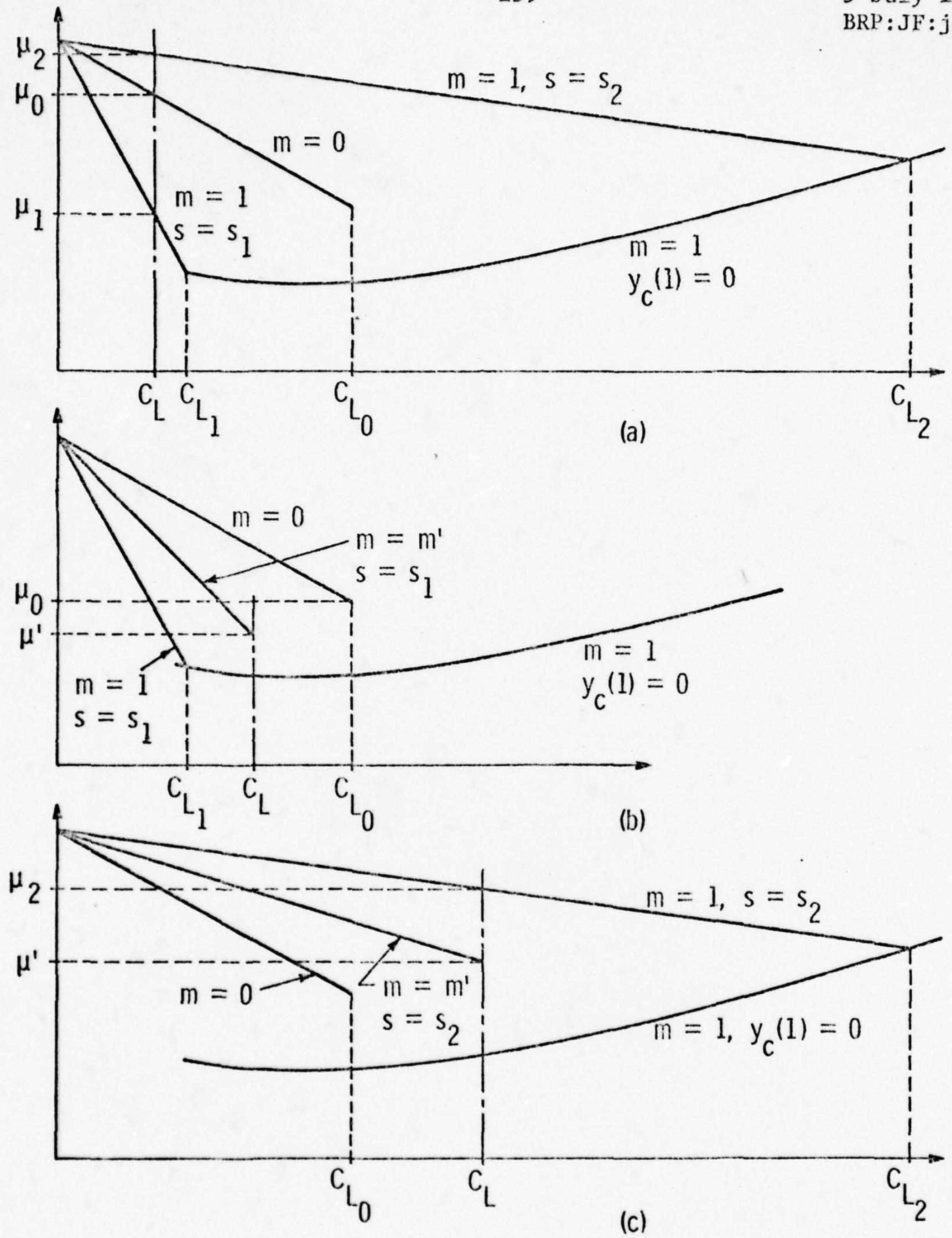


Figure 16 - Three C_L Intervals which Govern the Computation of the Permissible Range of μ

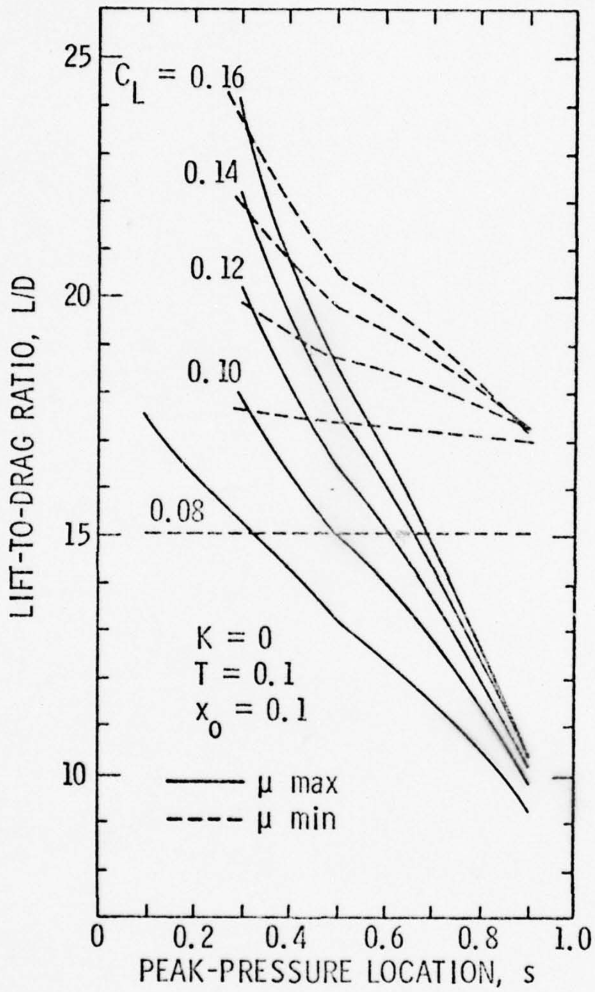


Figure 17 - Effect of Permissible Values of μ on L/D for Semi-Elliptical Pressure Distributions at K=0 and Various C_L

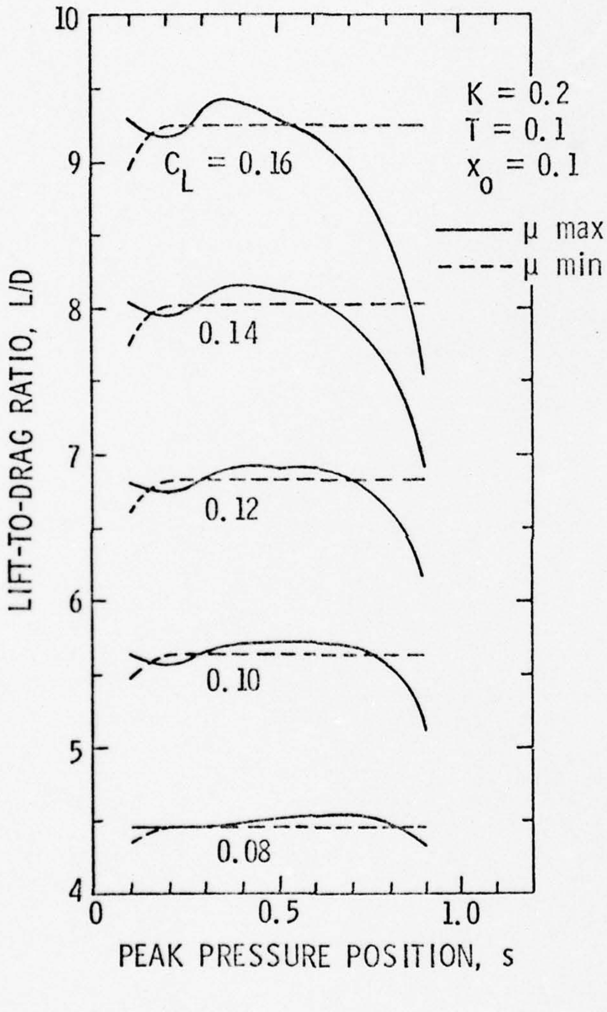


Figure 18 - Effect of Permissible Values of μ on L/D for Semi-Elliptical Pressure Distributions at K=0.2 and Various C_L

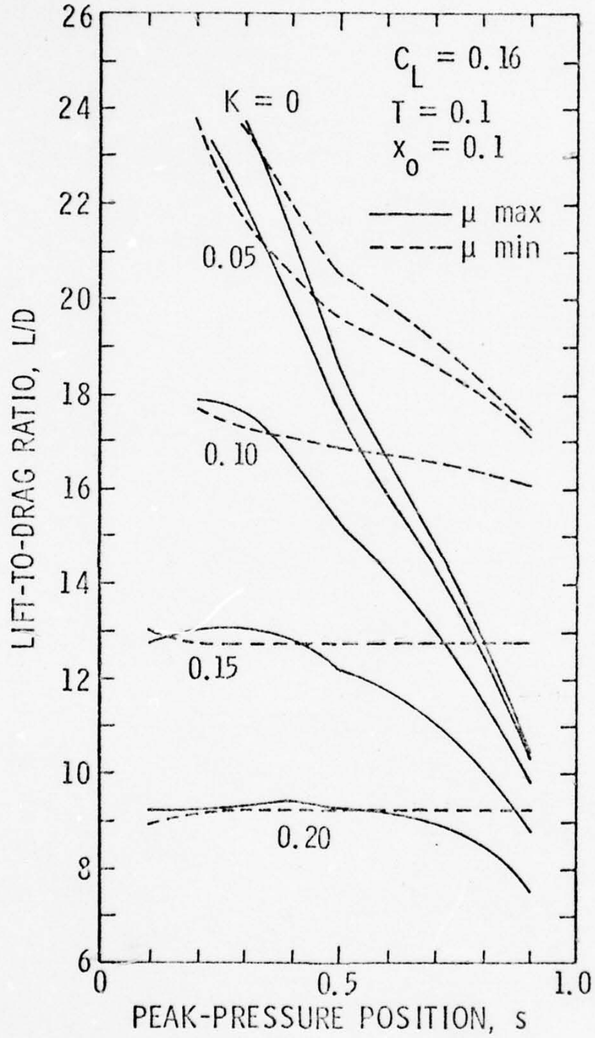


Figure 19 - Effect of Permissible Values of μ on L/D for Semi-Elliptical Pressure Distributions at Various Cavitation Numbers and Fixed C_L

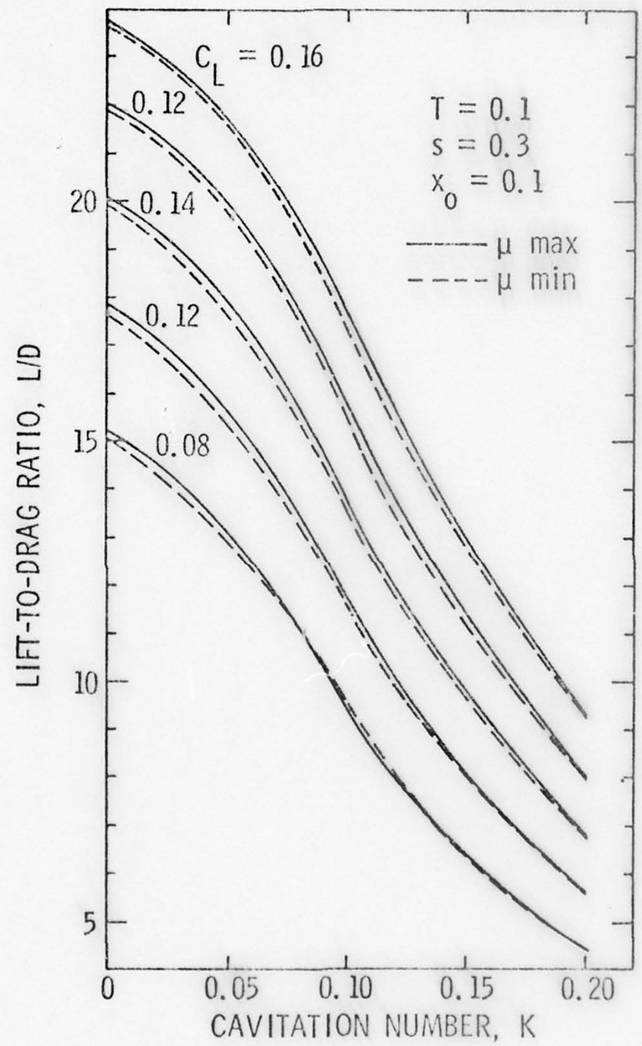


Figure 20 - Effect of Permissible Values of μ on L/D for a Fixed Peak Pressure Location and Ranges of K and C_L

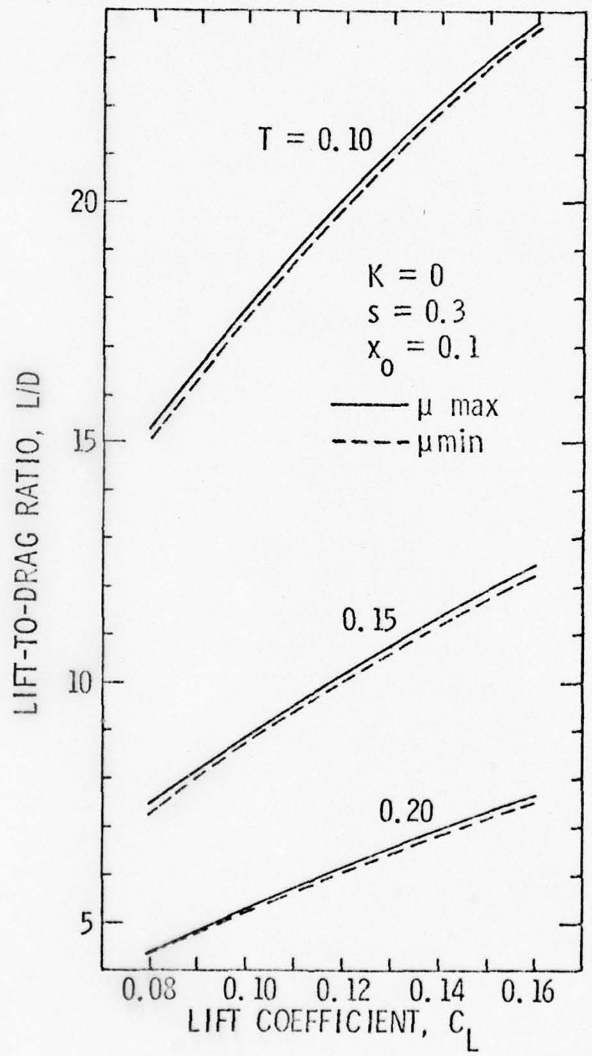


Figure 21 - Effect of Permissible Values of μ on L/D for Various Cavity Thicknesses and Lift Coefficients

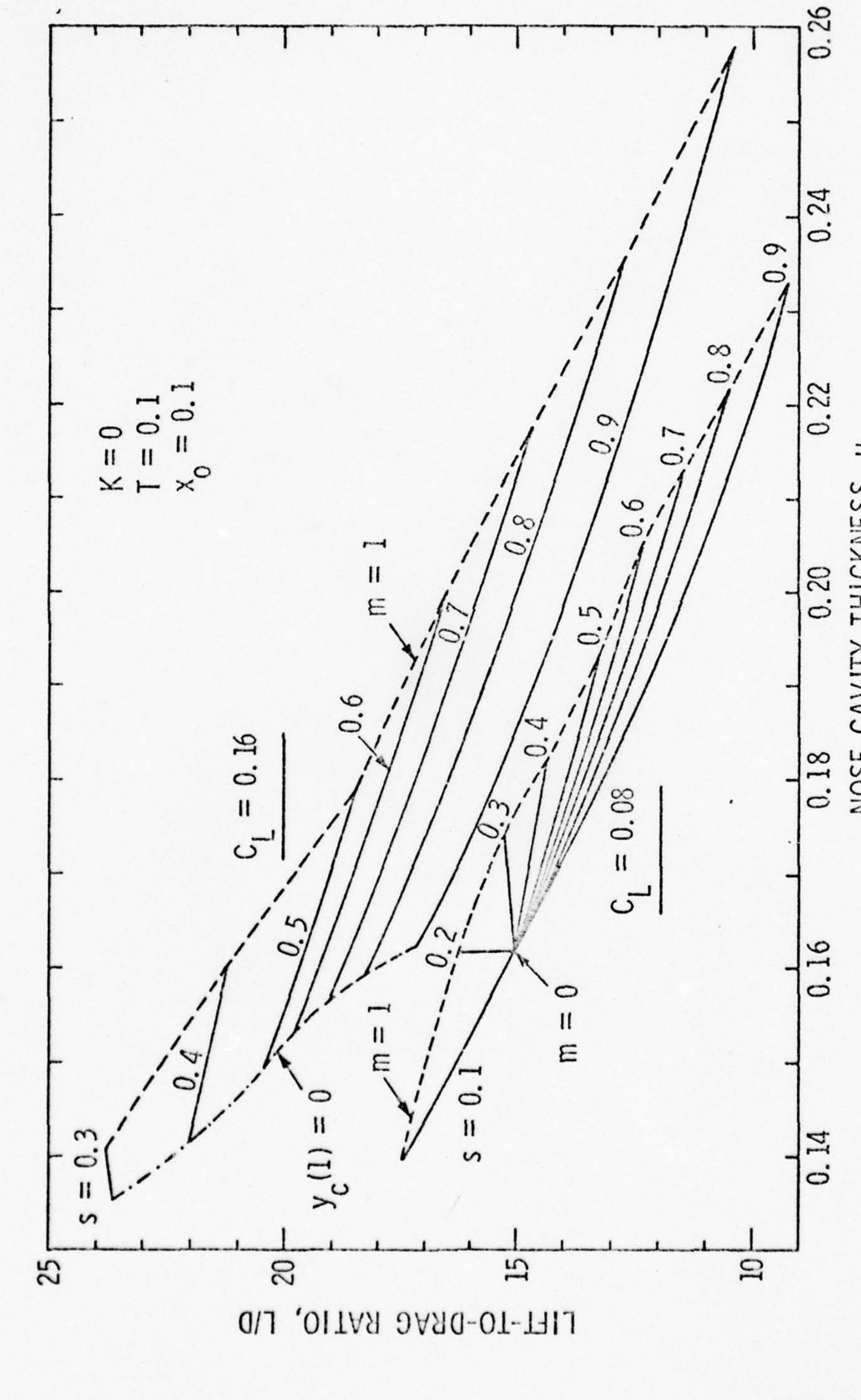


Figure 22 - General Effect of μ on L/D for Two Values of C_L and Fixed Values of K, T and X_o

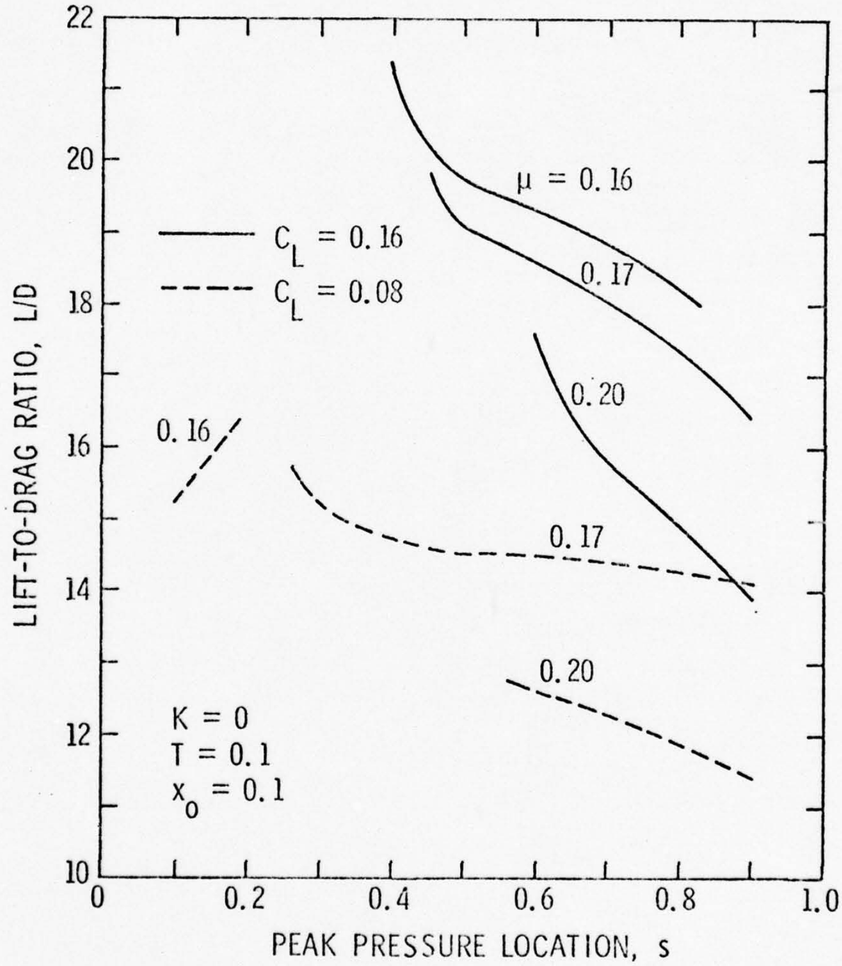


Figure 23 - Cross Plots from Figure 22 Showing Trends of L/D for Various Fixed Values of μ

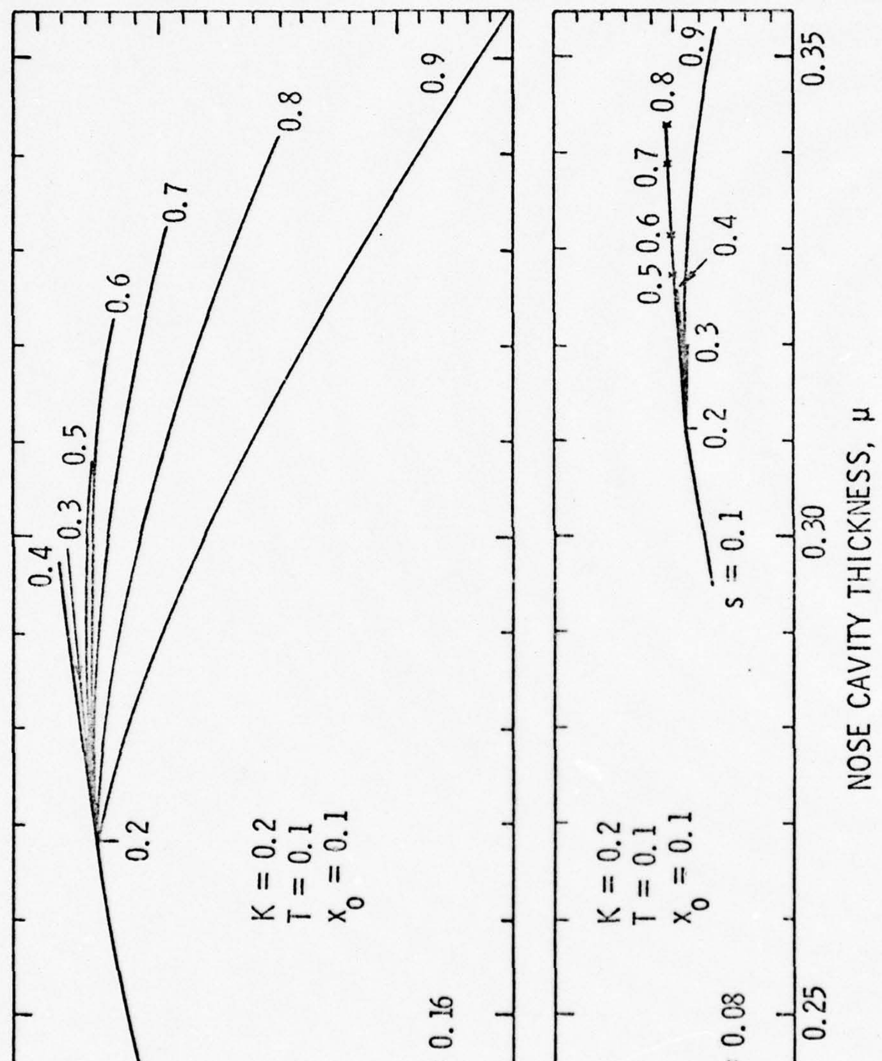


Figure 24 - General Effect of μ on L/D for Two Values of C_L at K=.2

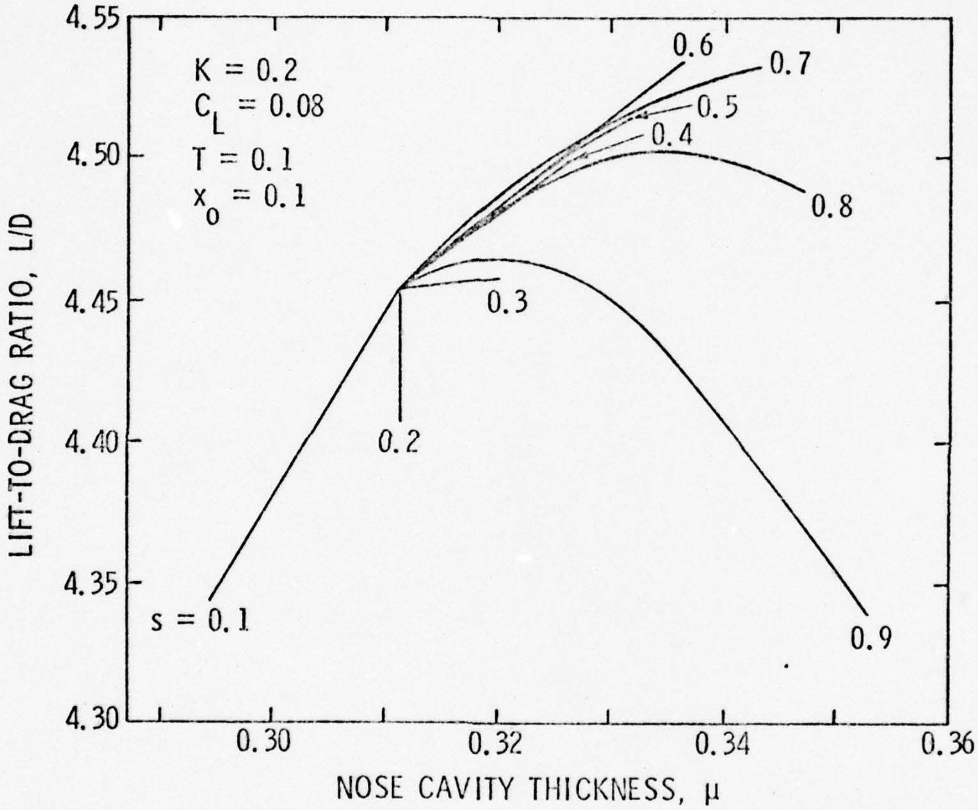
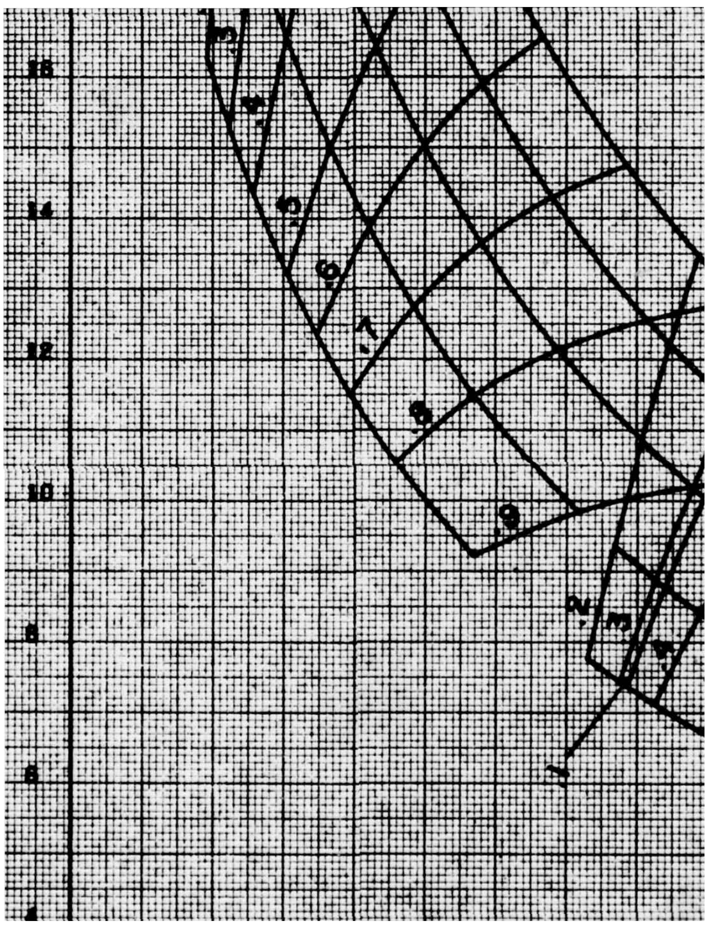
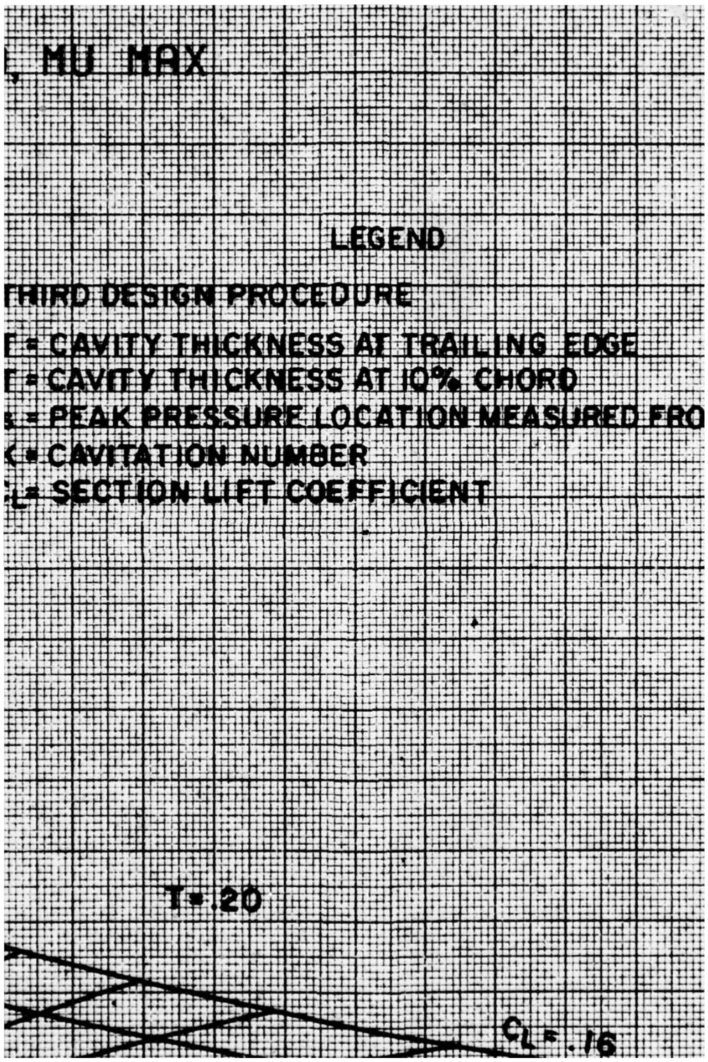


Figure 25 - Replot of Figure 24 Showing the Effect of μ on L/D when K=.2 and C_L=.08


16
14
12
10
8
6
1
2
3
4
5
6
7
8
9


, MU MAX
LEGEND
THIRD DESIGN PROCEDURE
T = CAVITY THICKNESS AT TRAILING EDGE
T = CAVITY THICKNESS AT 10% CHORD
= PEAK PRESSURE LOCATION MEASURED FRO
K = CAVITATION NUMBER
C_L = SECTION LIFT COEFFICIENT
T = .20
C_L = .16

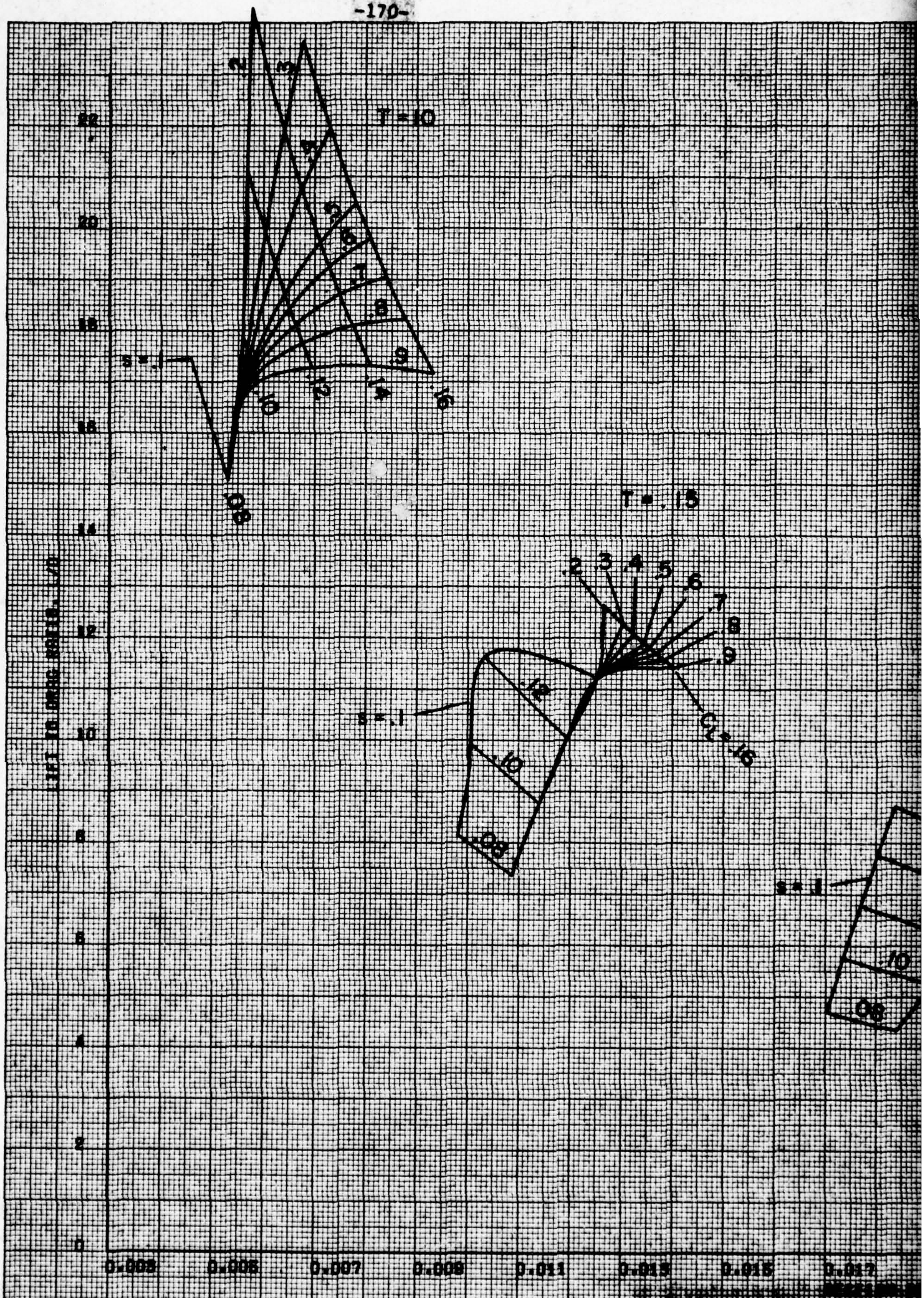
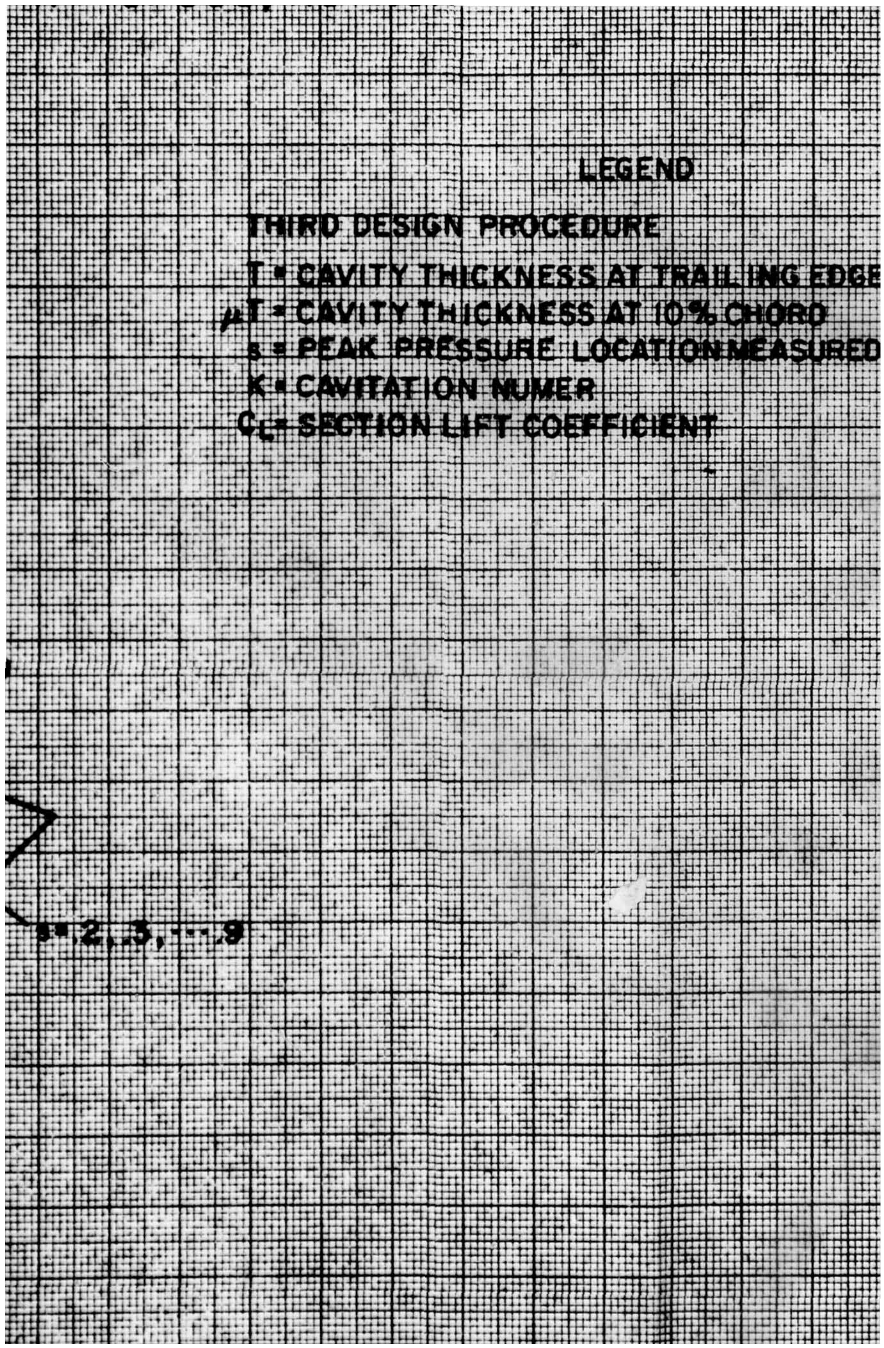
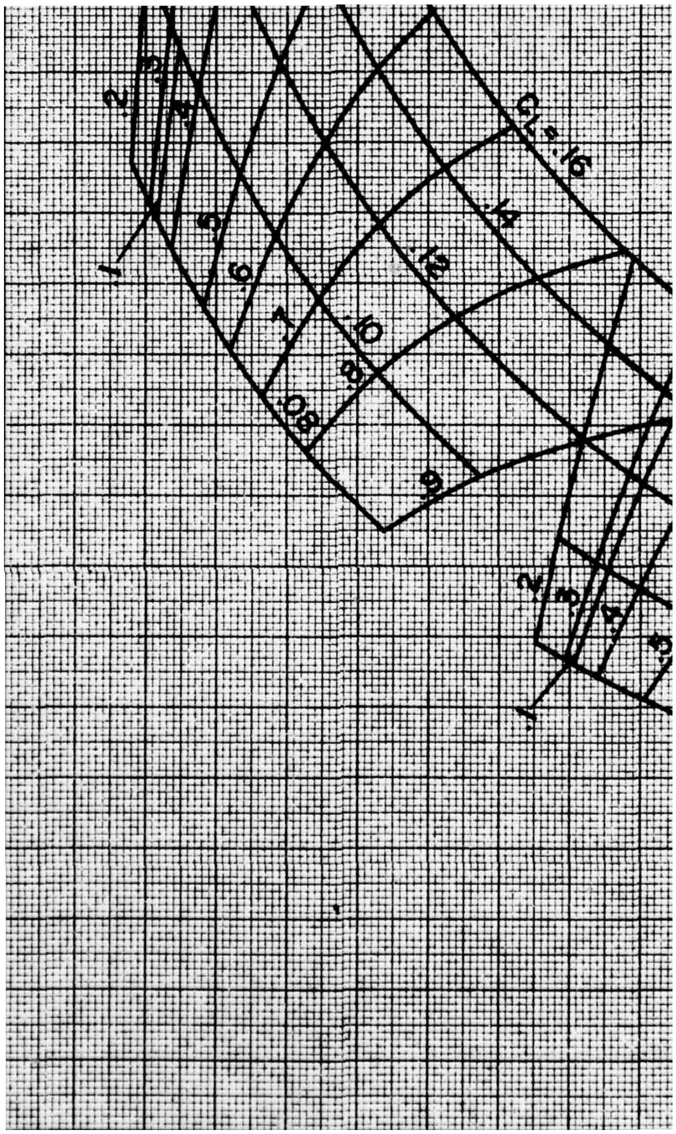
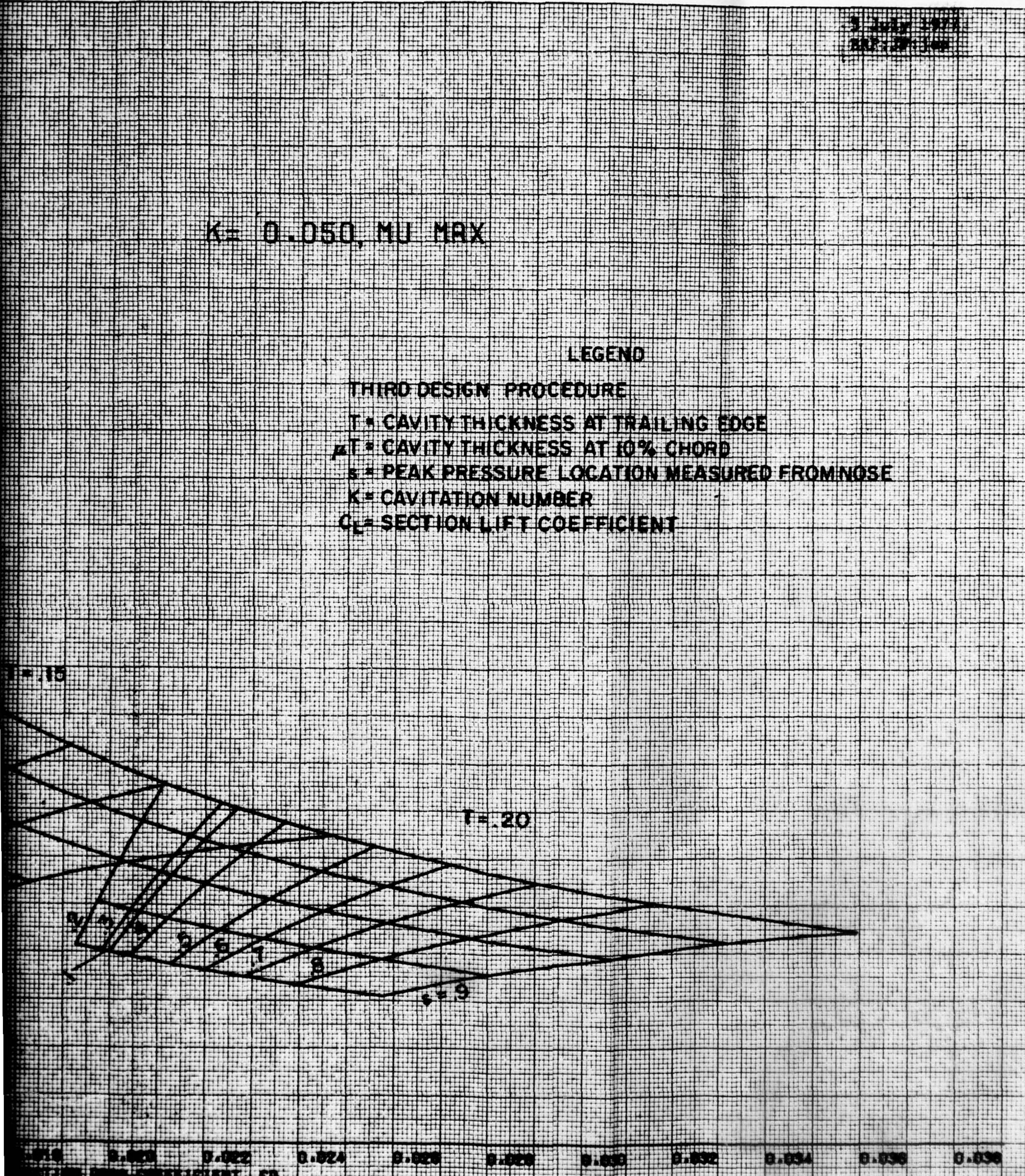


Figure 27 - Third Design
K=0.000, M


LEGEND
THIRD DESIGN PROCEDURE
T = CAVITY THICKNESS AT TRAILING EDGE
μT = CAVITY THICKNESS AT 10% CHORD
s = PEAK PRESSURE LOCATION MEASURED
K = CAVITATION NUMER
C_L = SECTION LIFT COEFFICIENT
s = .2, .3, - - - .9



CL = .16
.14
.12
.10
.08
.1
.2
.3
.4
.5
.6
.7
.8
.9



Design Procedure L/D Performance Map,
0, MU MAX

2

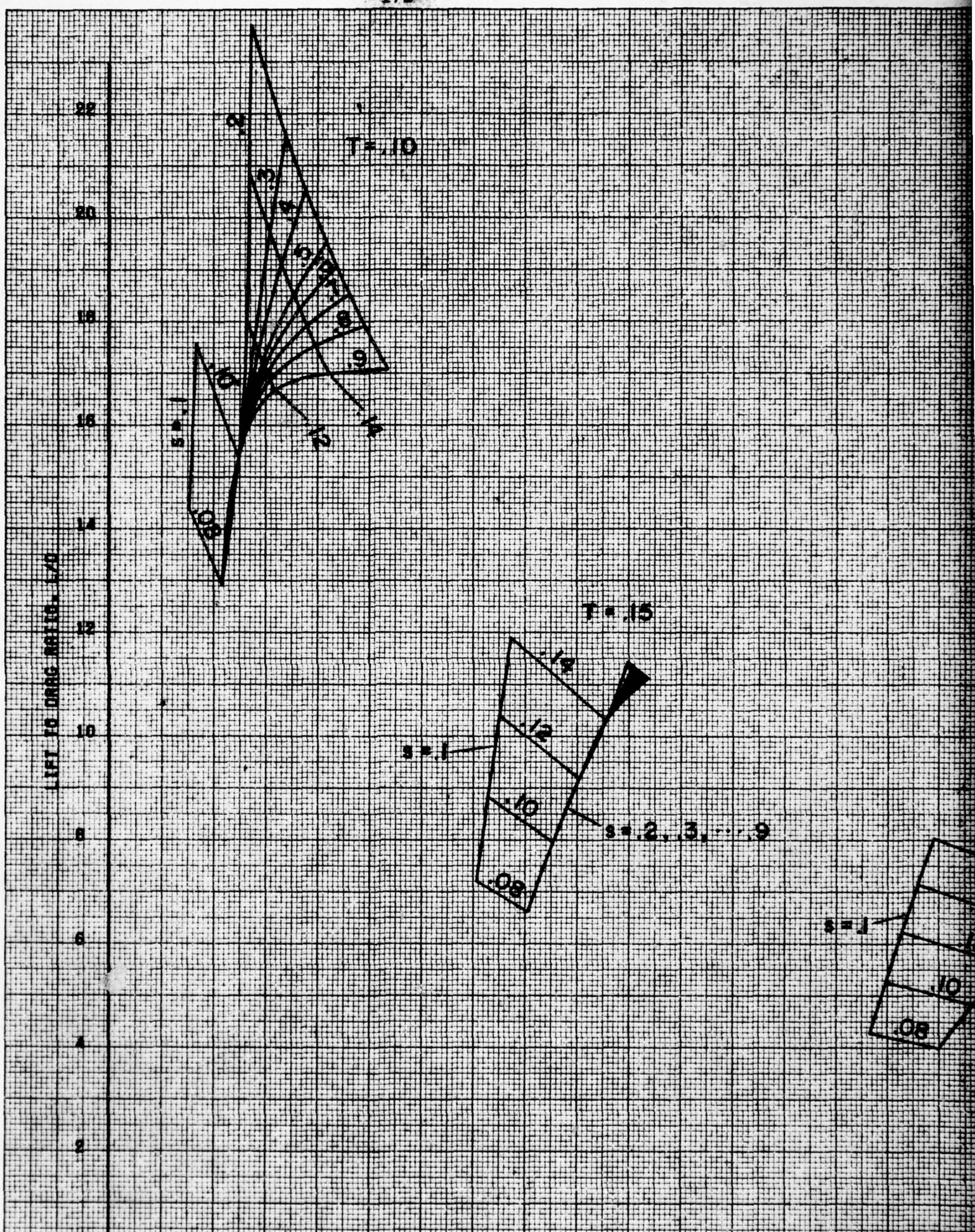
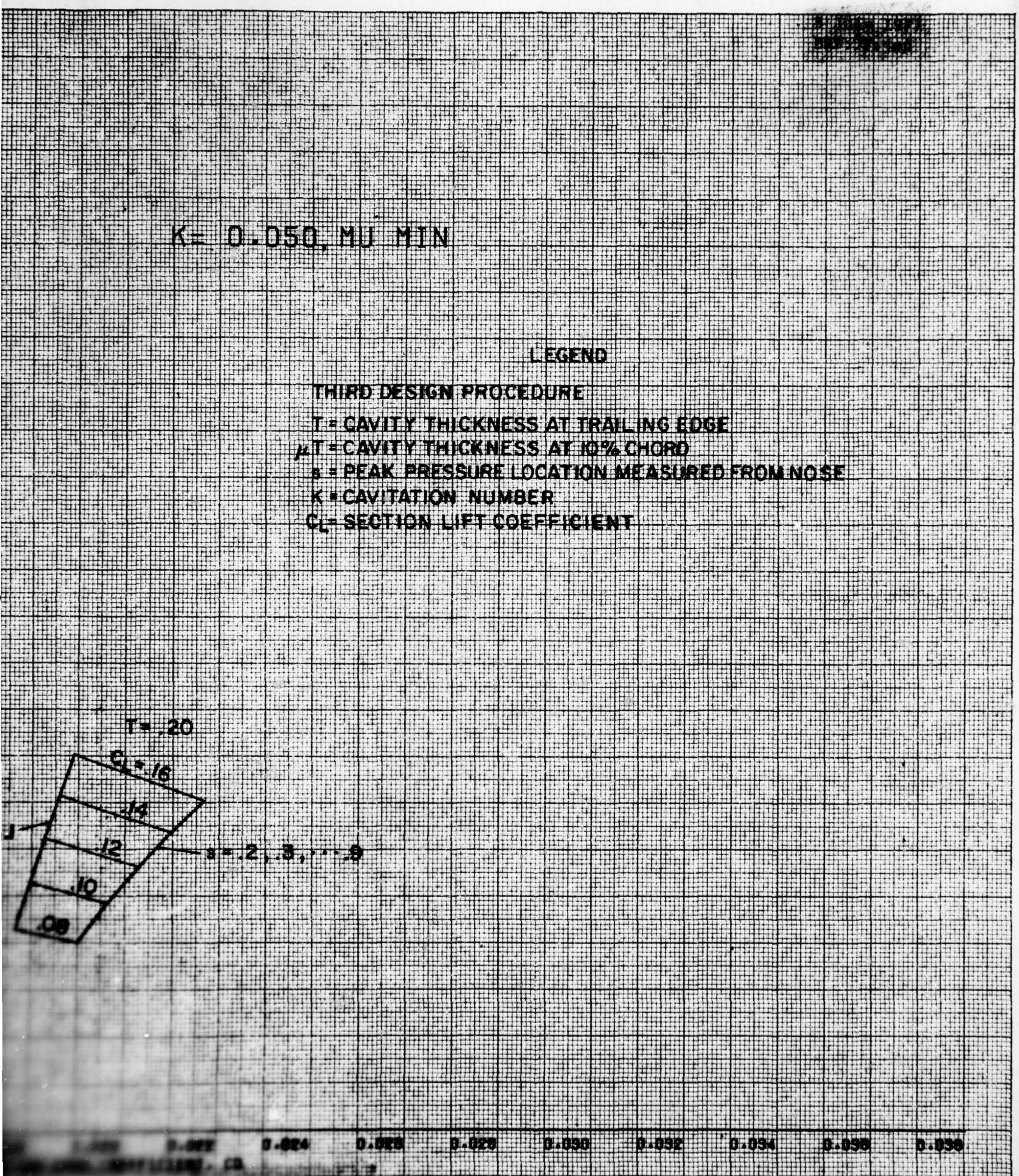


Figure 29 - Third Design Prod
K=0.050, MR MIN



Lift Performance Map.

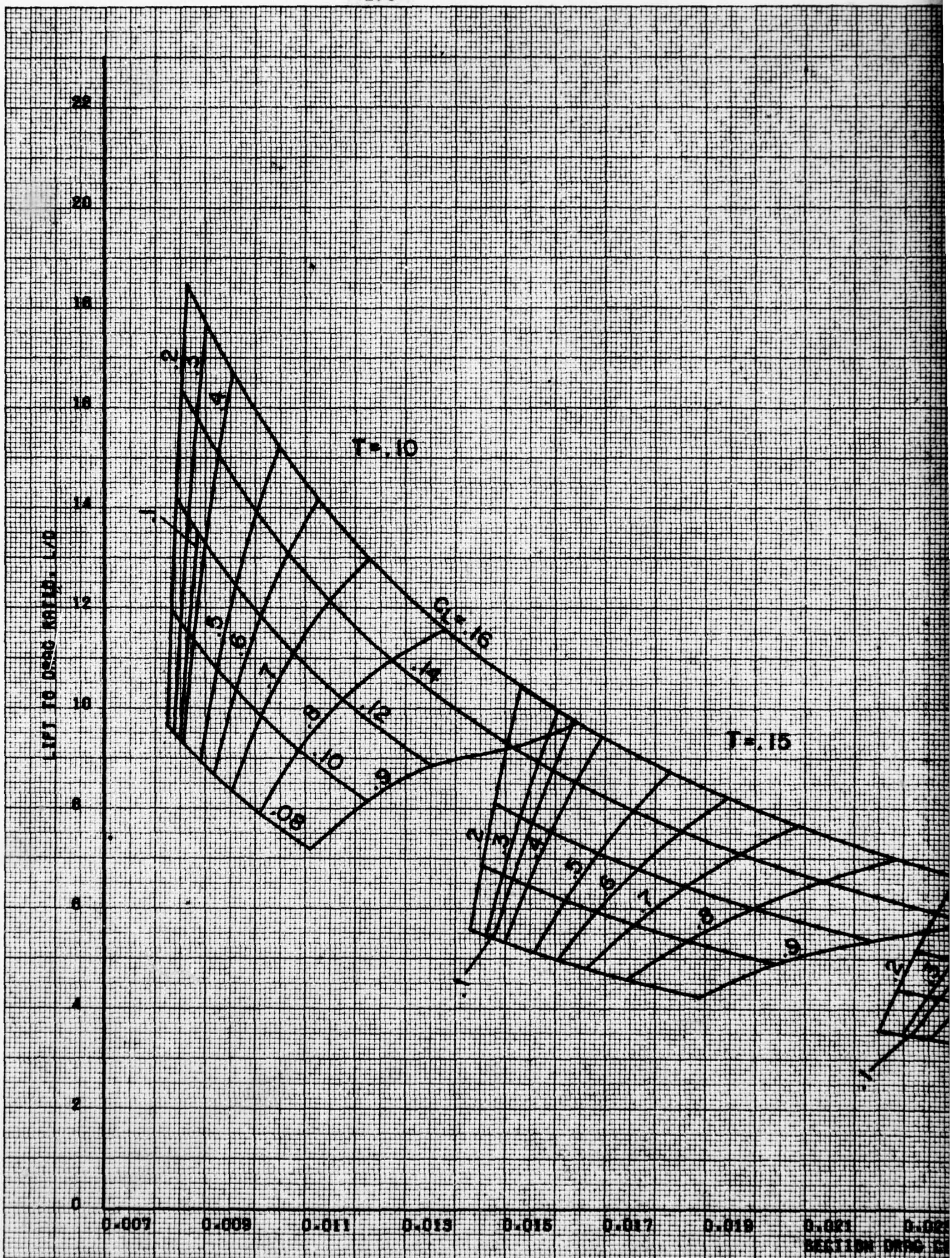
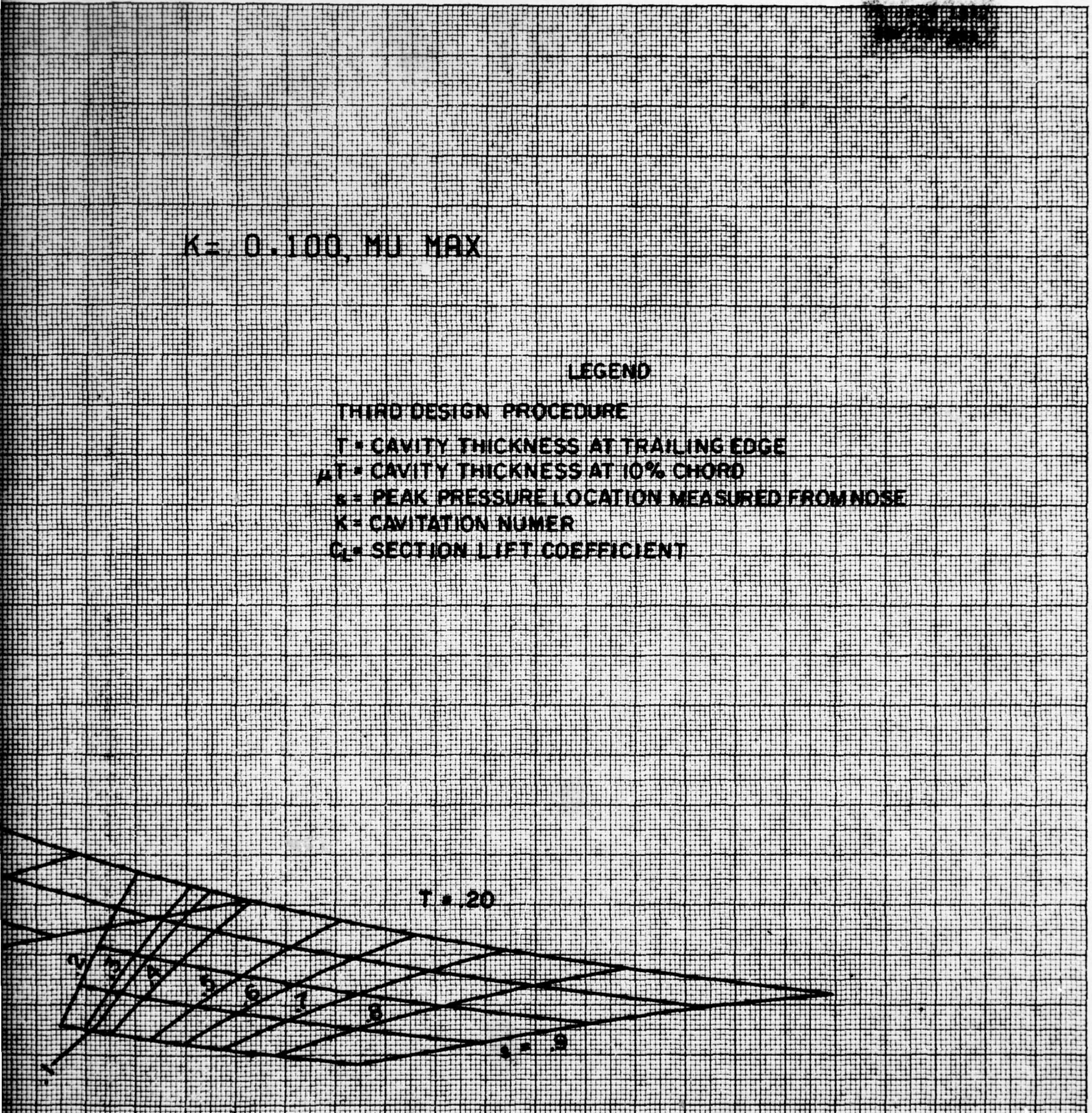
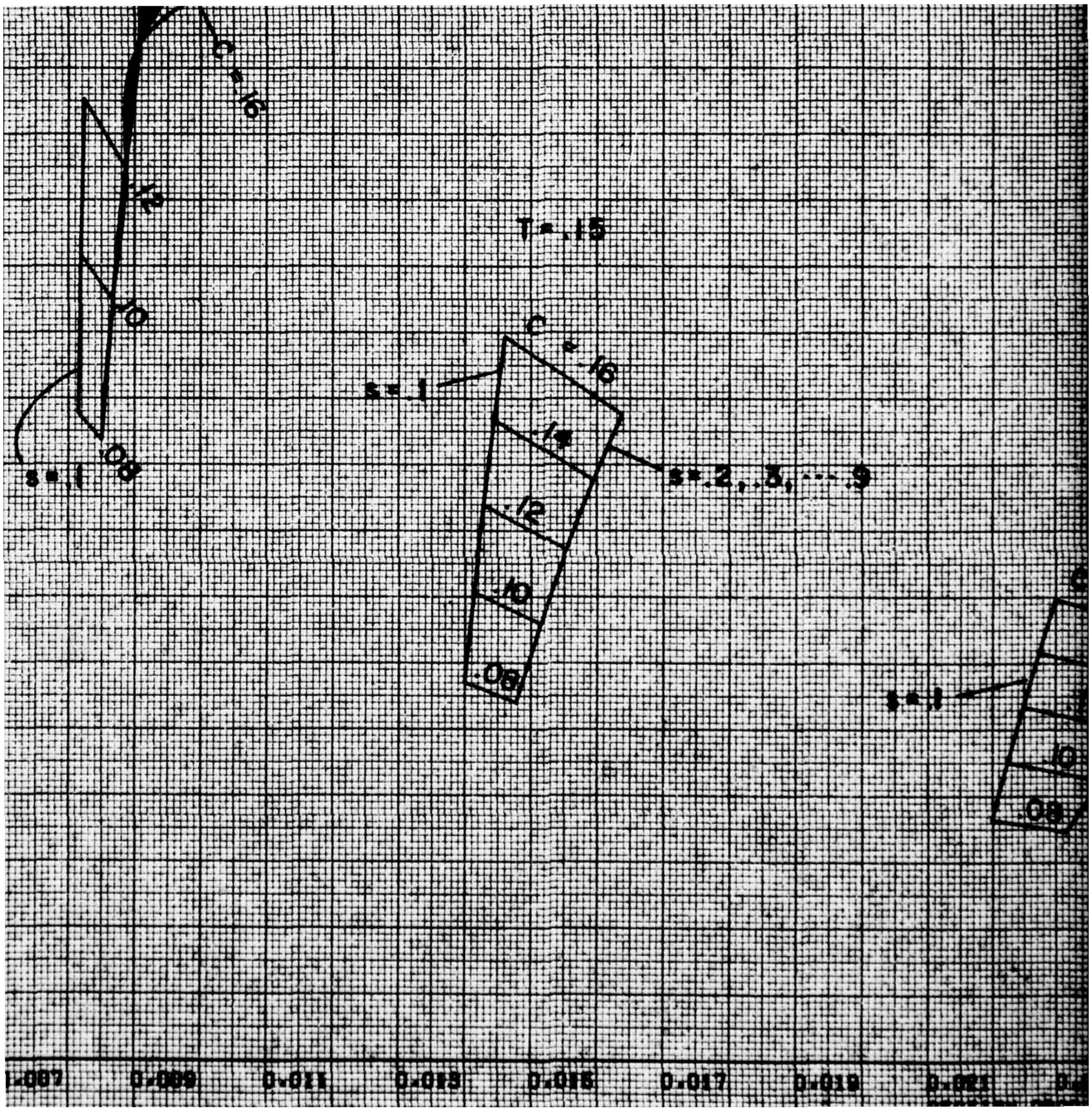


Figure 30 - Third Design Procedu
K=0.100, MU MAX

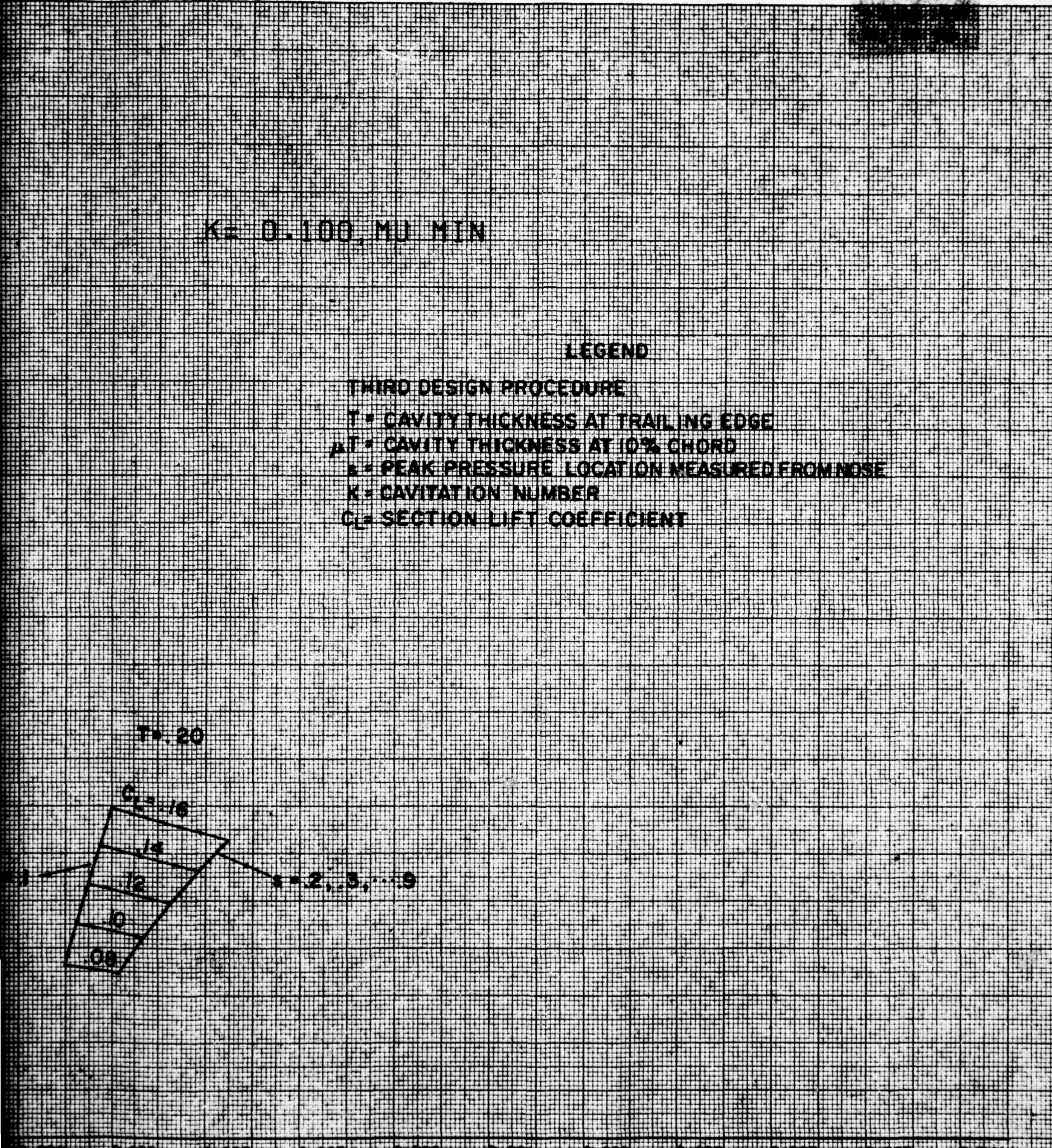


gn Procedure L/D Performance Map,
U MAX

7

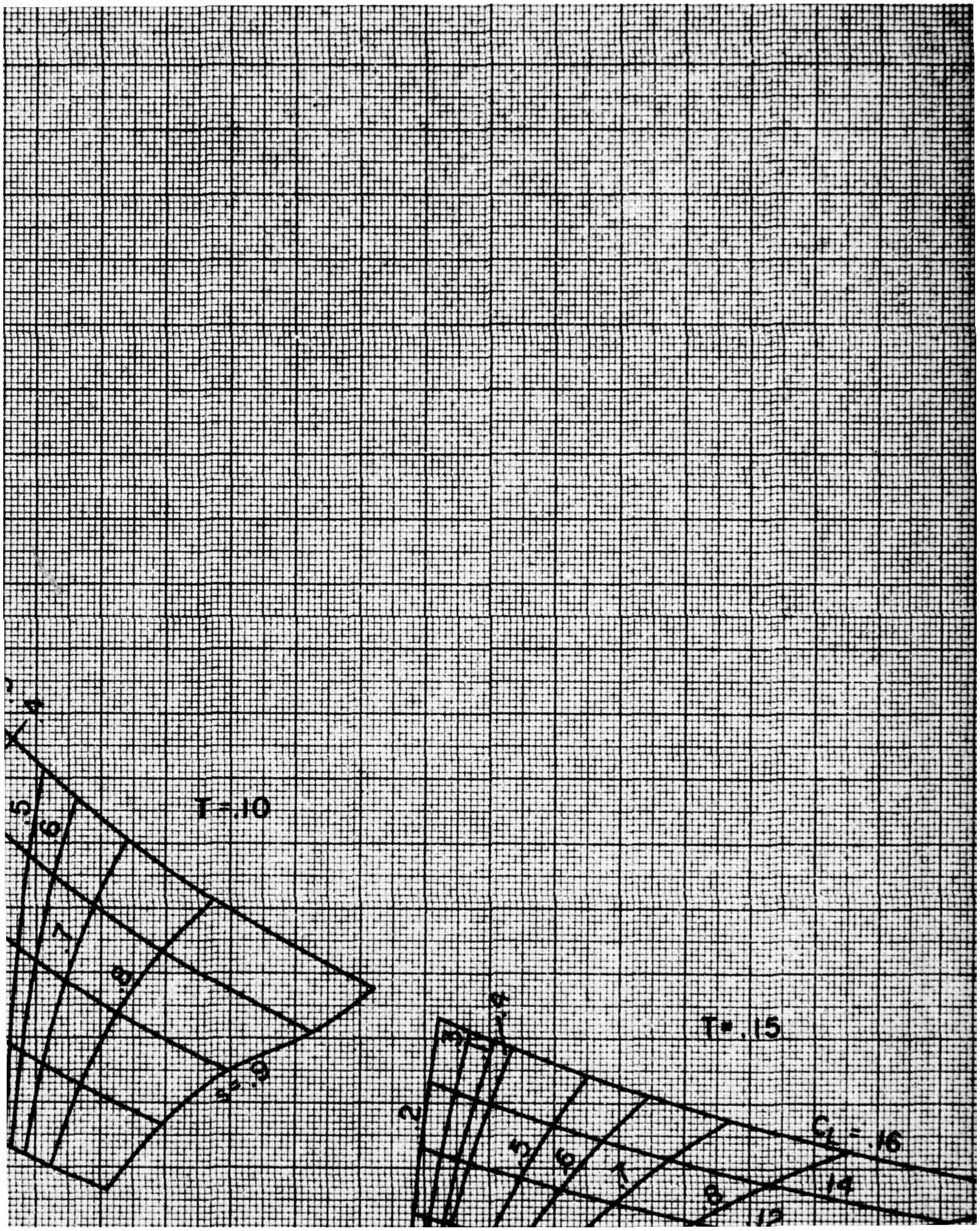


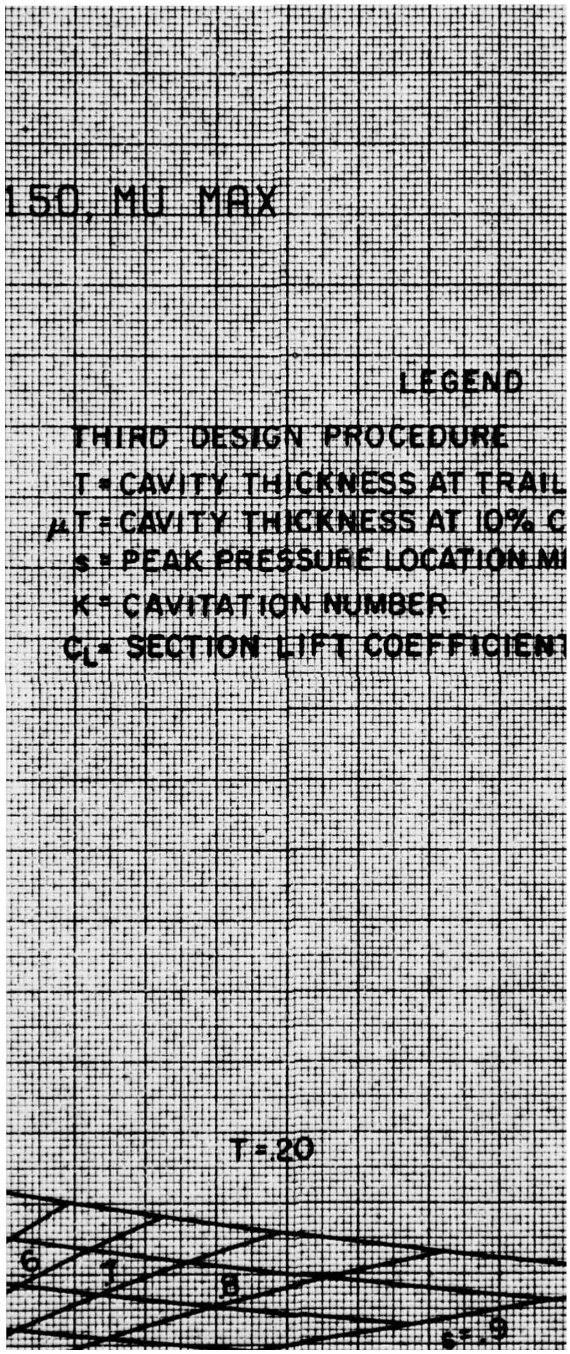
C = .16
.12
.10
.08
s = .1
T = .15
C = .16
s = .1
.14
s = .2, .3, ...9
.12
.10
.08
s = .1
.10
.08
0.009
0.011
0.013
0.015
0.017
0.019
0.021

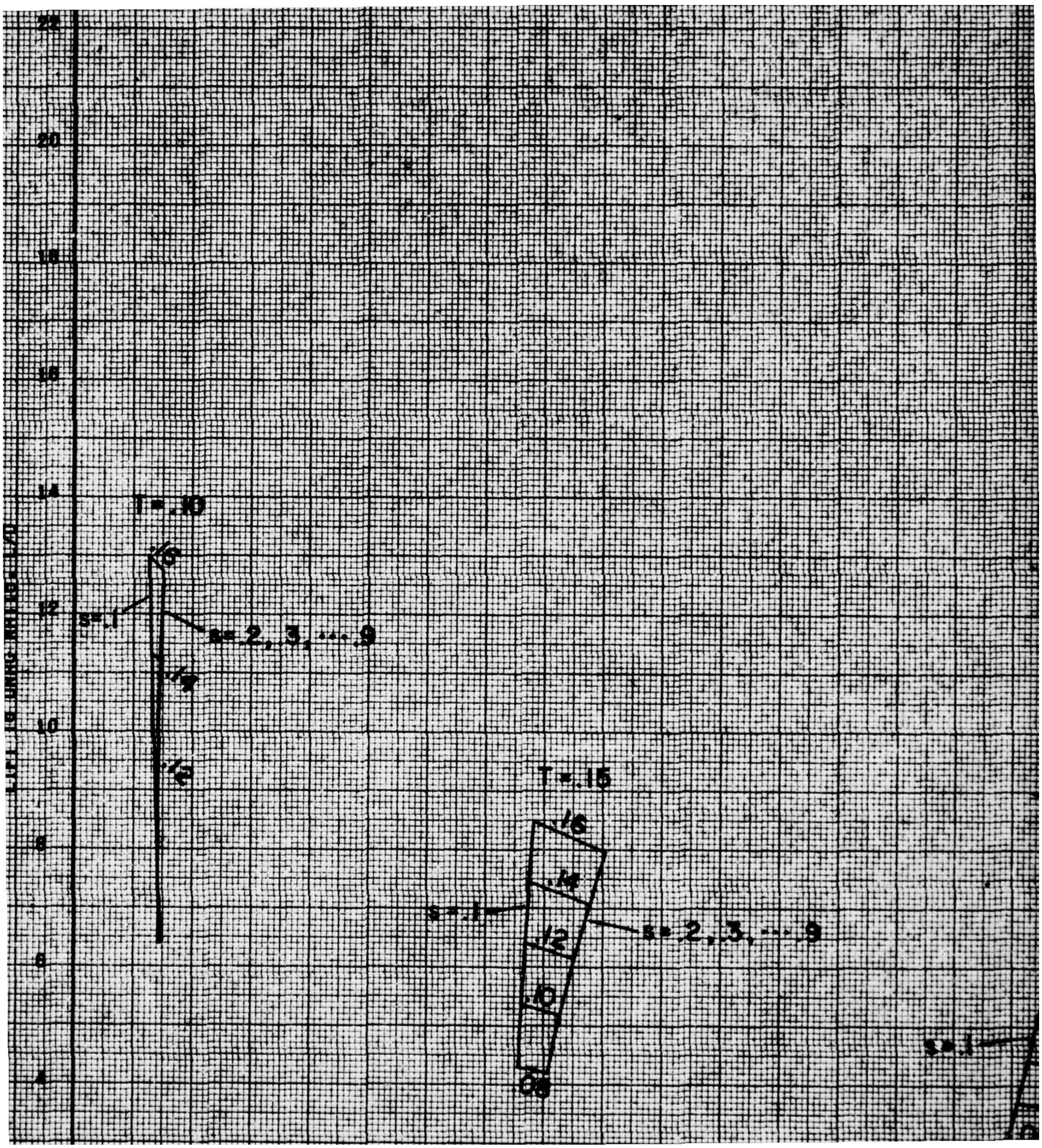


Design Procedure L/D Performance Map,
00, MU MIN

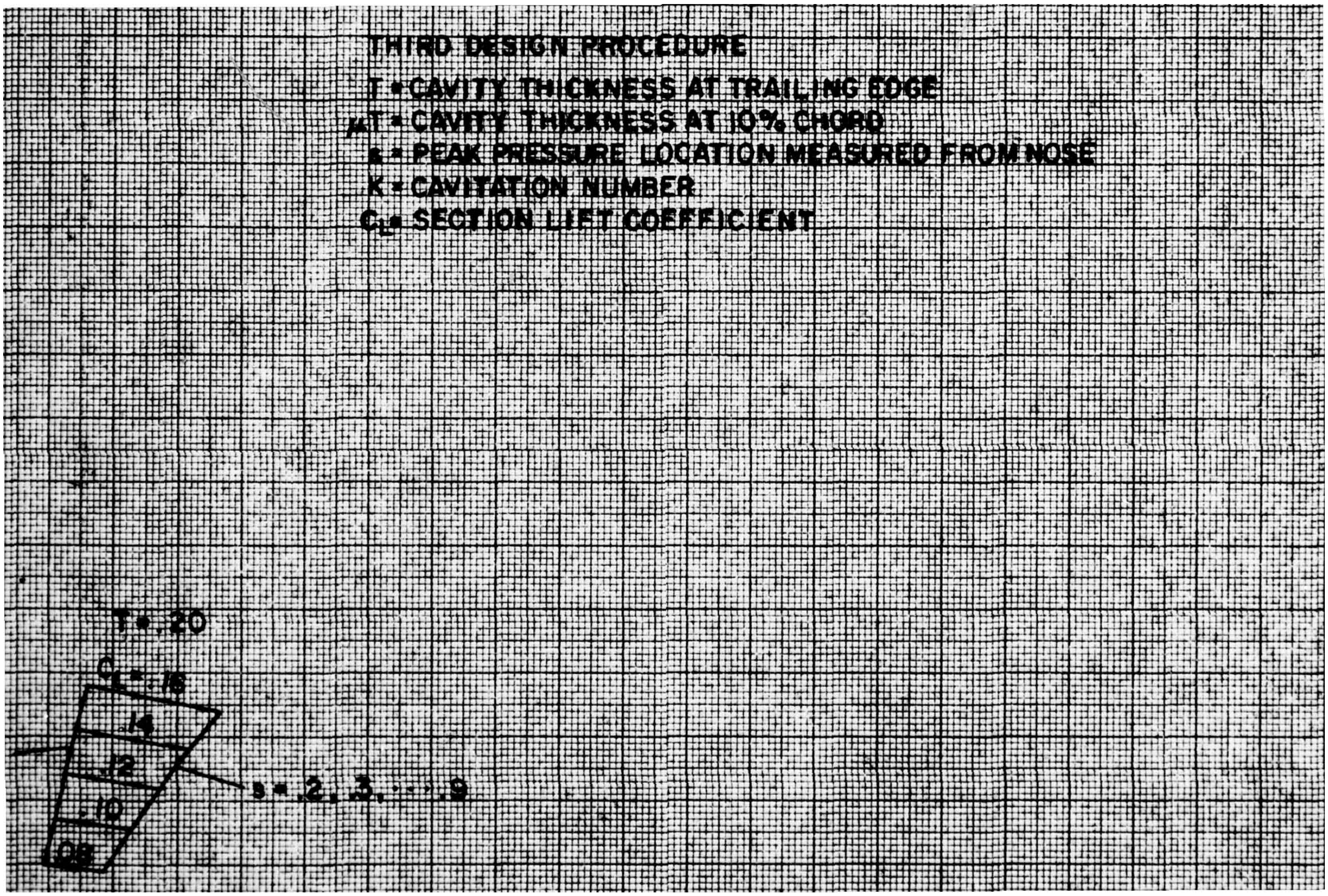
7


T = .10
s = .9
T = .15
C_L = .16

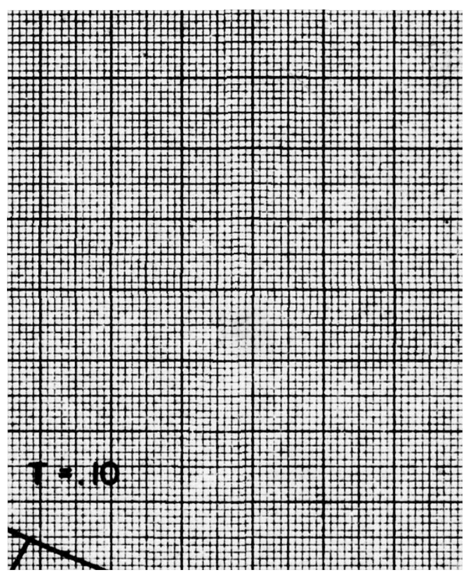

150, MU MAX
LEGEND
THIRD DESIGN PROCEDURE
T = CAVITY THICKNESS AT TRAIL
μT = CAVITY THICKNESS AT 10% C
s = PEAK PRESSURE LOCATION MI
K = CAVITATION NUMBER
CL = SECTION LIFT COEFFICIENT
T=.20
6
7
8
s=.9

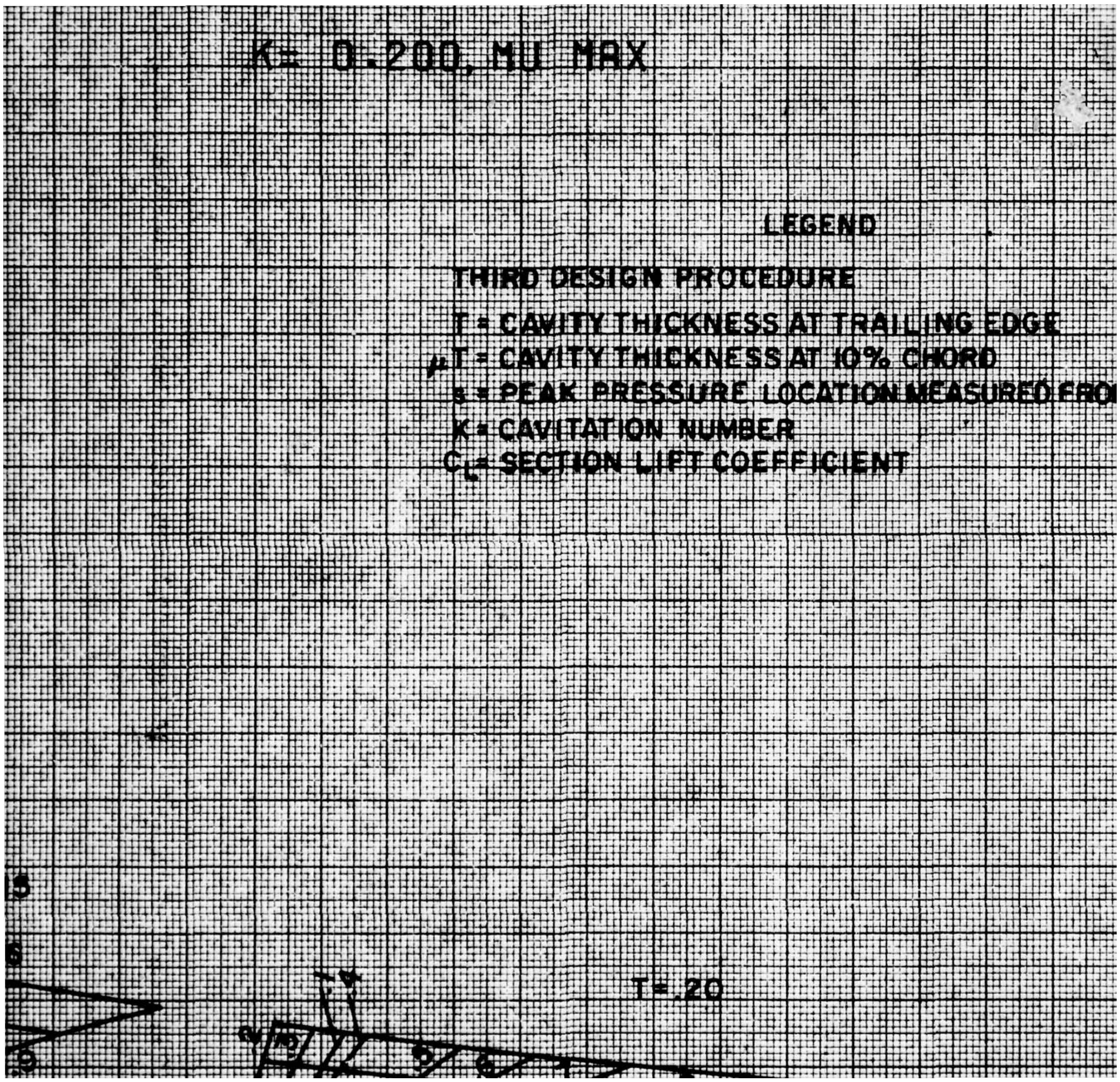


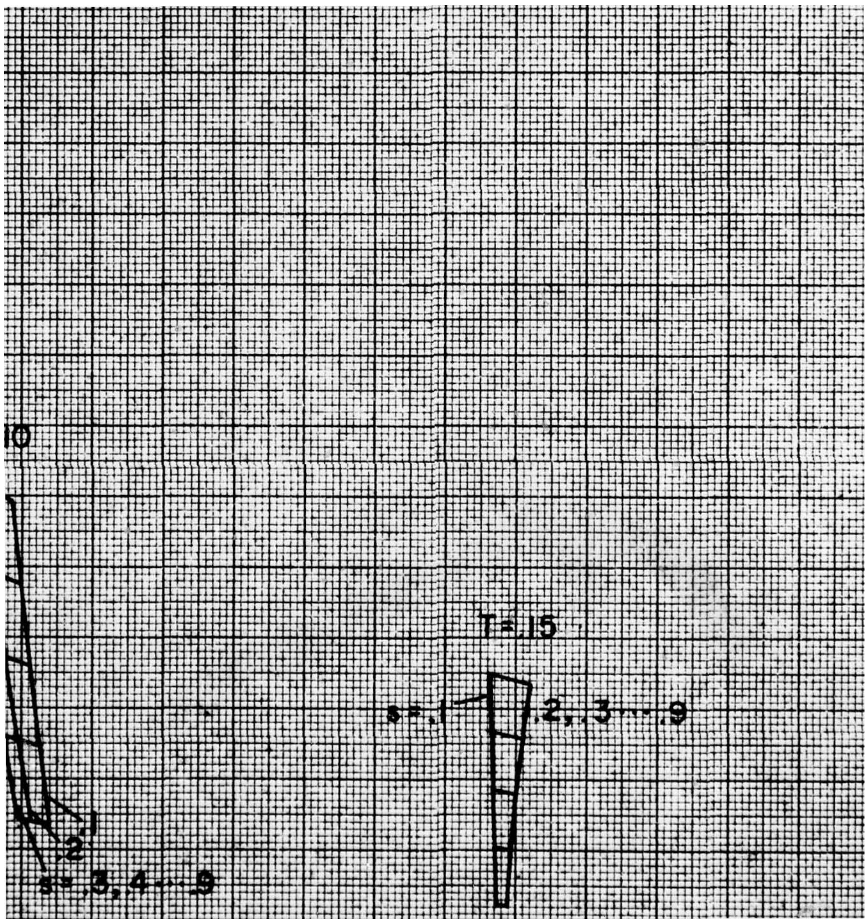
22
20
18
16
14
12
10
8
6
4
T = .10
.16
s=.1
s=.2, .3, ...9
.14
.12
T = .15
.16
.14
s=.1
s=.2, .3, ...9
.12
.10
.08
s=.1



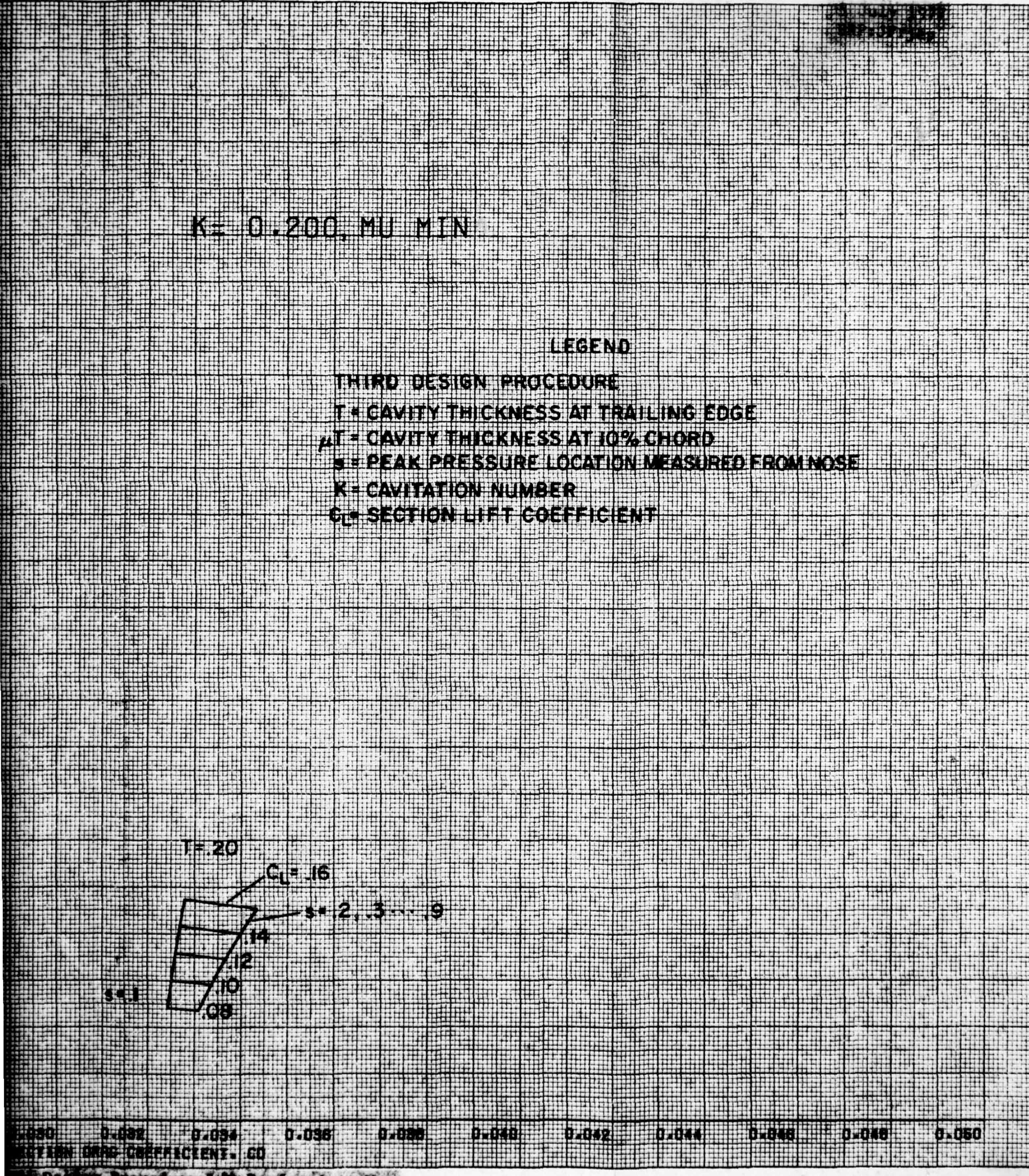
THIRD DESIGN PROCEDURE
T = CAVITY THICKNESS AT TRAILING EDGE
μT = CAVITY THICKNESS AT 10% CHORD
s = PEAK PRESSURE LOCATION MEASURED FROM NOSE
K = CAVITATION NUMBER
C_L = SECTION LIFT COEFFICIENT
T = .20
C_L = .16
.14
.12
.10
.08
s = .2, .3, ..., .9


T = .10


K= 0.200, MU MAX
LEGEND
THIRD DESIGN PROCEDURE
T = CAVITY THICKNESS AT TRAILING EDGE
μT = CAVITY THICKNESS AT 10% CHORD
s = PEAK PRESSURE LOCATION MEASURED FRO
K = CAVITATION NUMBER
CL = SECTION LIFT COEFFICIENT
T=.20



10
.2
.1
s=.3, .4 ··· .9
T=.15
s=.1
.2, .3 ··· .9



Design Procedure L/D Performance Map
.200, MU MIN

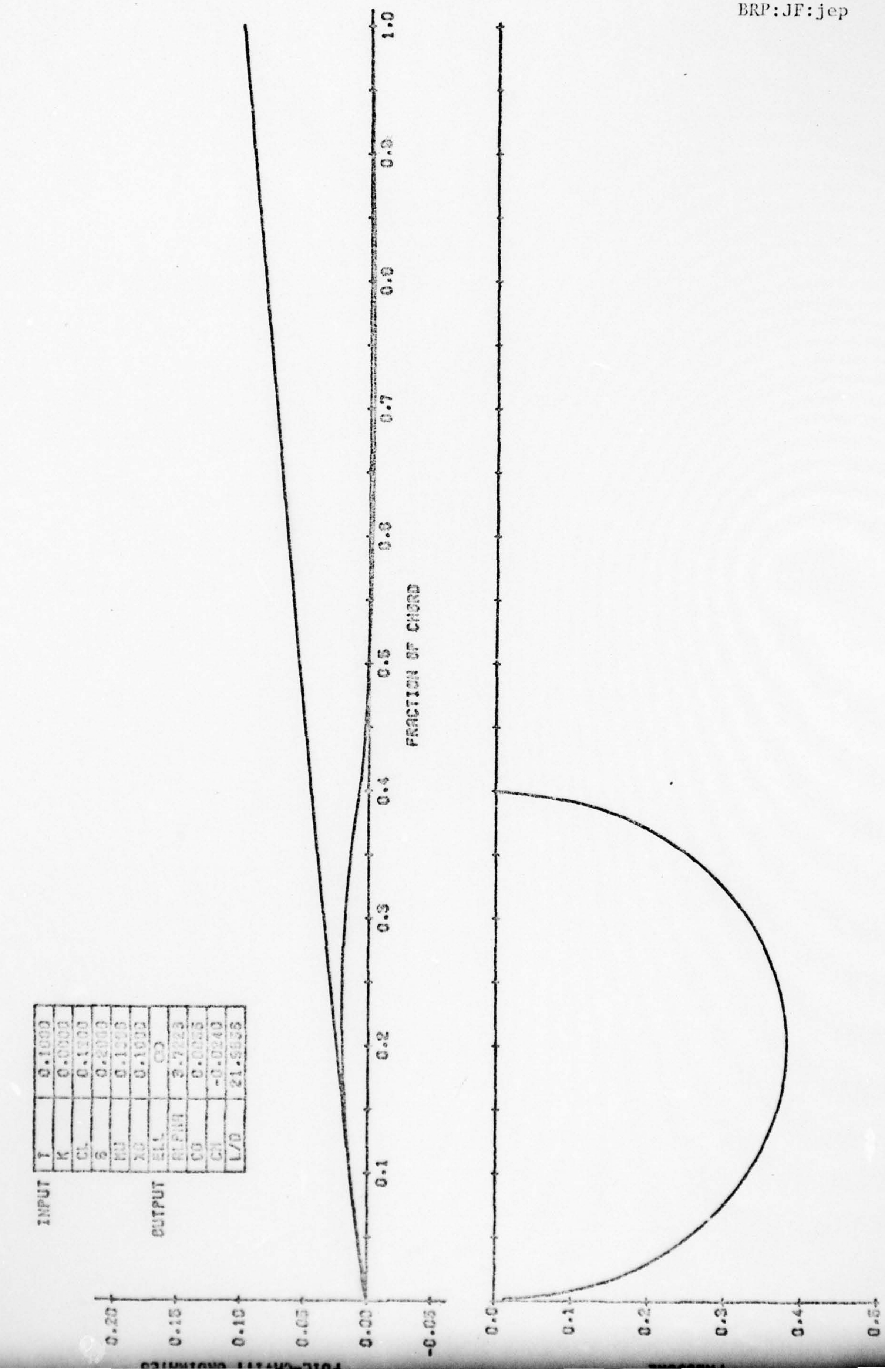


Figure 36 - Profile and Pressure Distribution for s=.2

AD-A044 784 PENNSYLVANIA STATE UNIV UNIVERSITY PARK APPLIED RESE--ETC F/G 20/4
A THIRD PROCEDURE FOR LINEARIZED FULLY CAVITATING HYDROFOIL SEC--ETC(U)
JUL 77 B R PARKIN, J FERNANDEZ N00017-73-C-1418
UNCLASSIFIED TM-77-186 NL

3 OF 3
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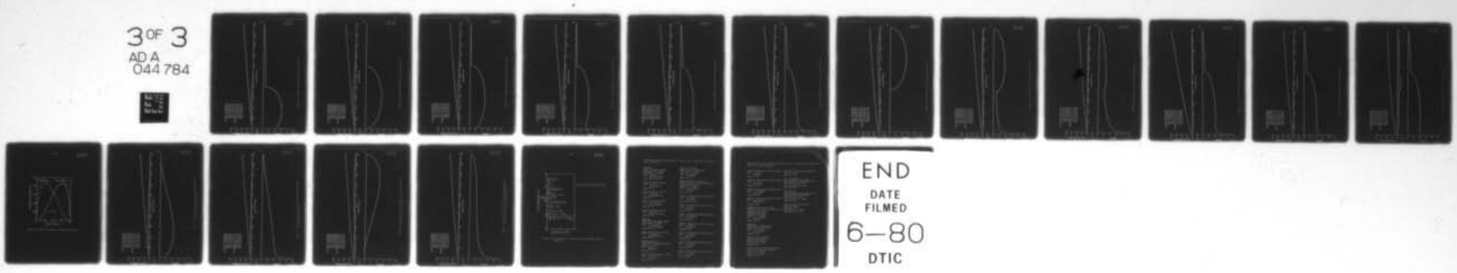

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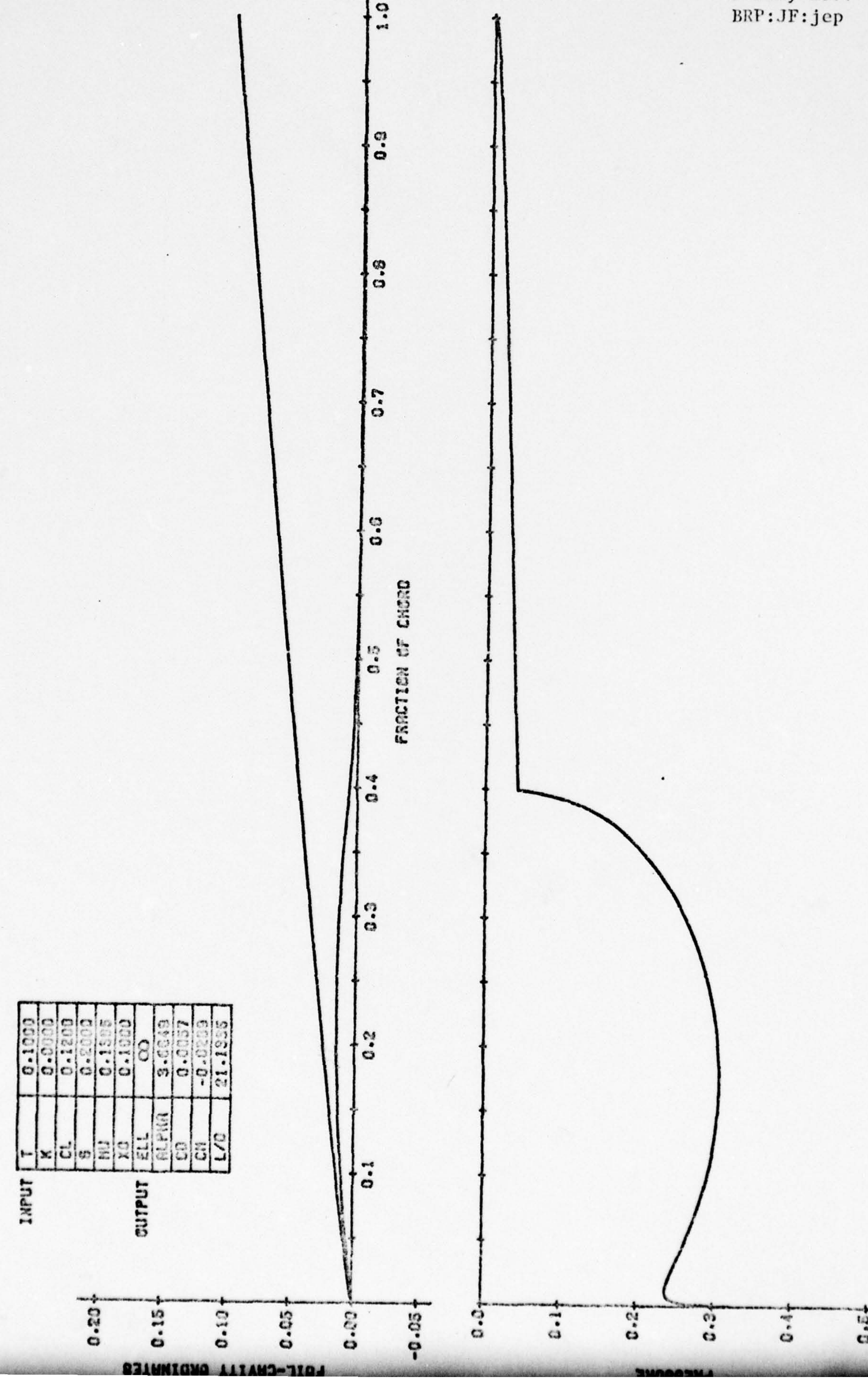

Figure 37 - Profile and Pressure Distribution for s=.2

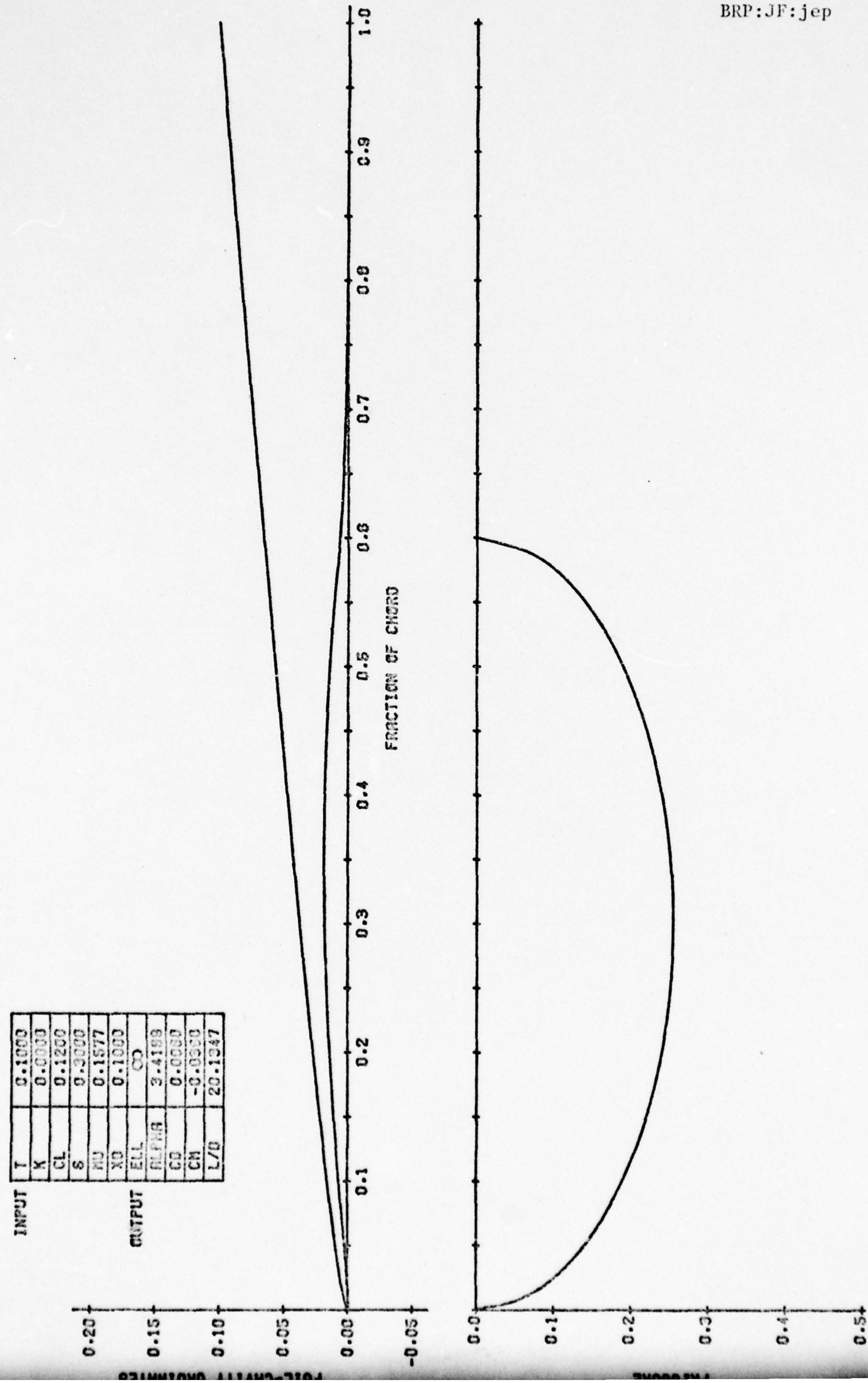

Figure 38 - Profile and Pressure Distribution for s=.3

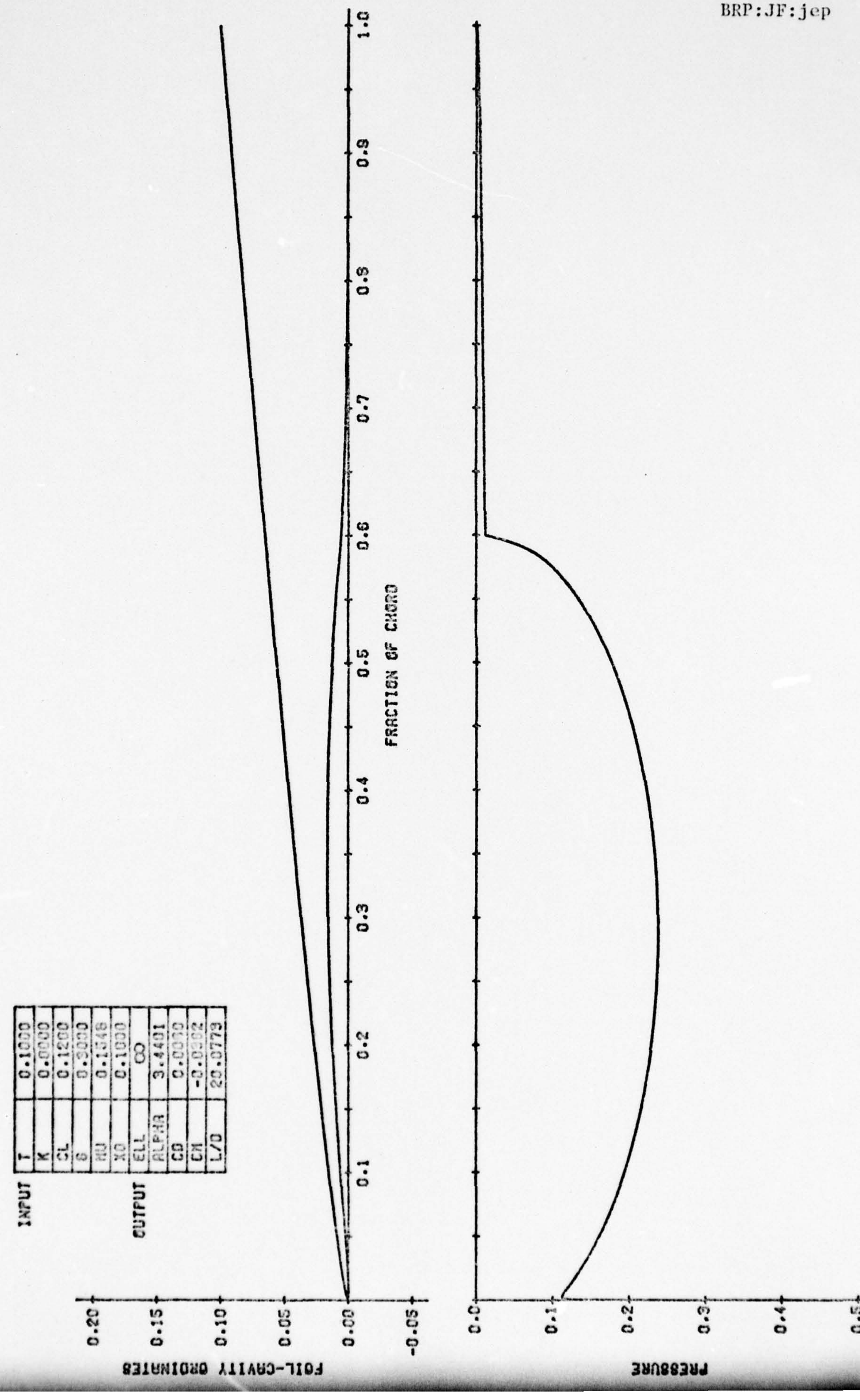

Figure 39 - Profile and Pressure Distribution for s=.3

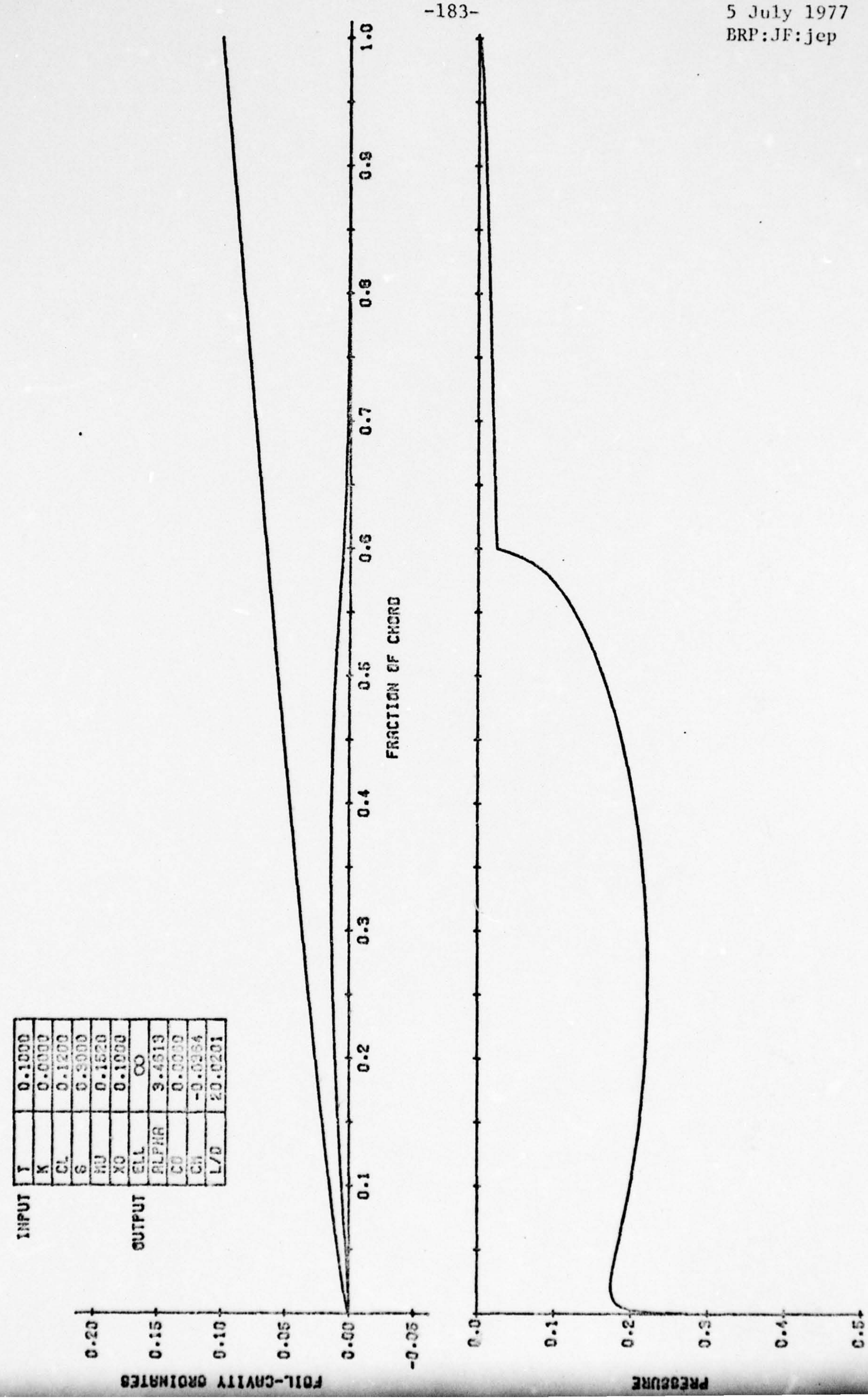

Figure 40 - Profile and Pressure Distribution for s=.3

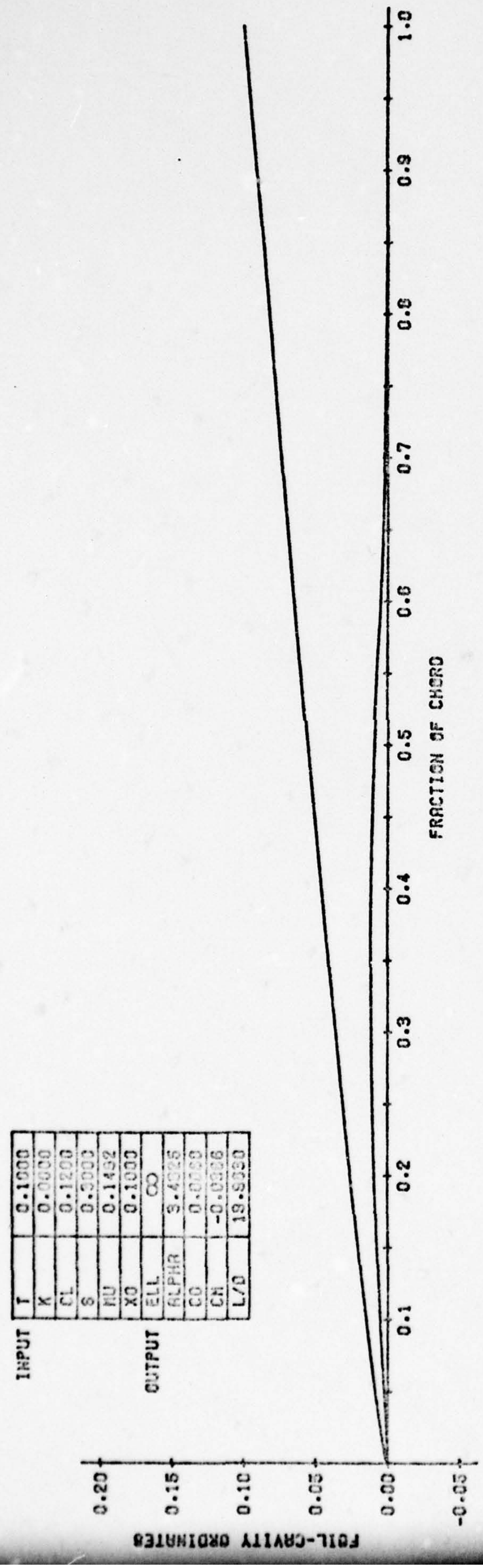

Figure 41 - Profile and Pressure Distribution for s=.3

5 July 1977
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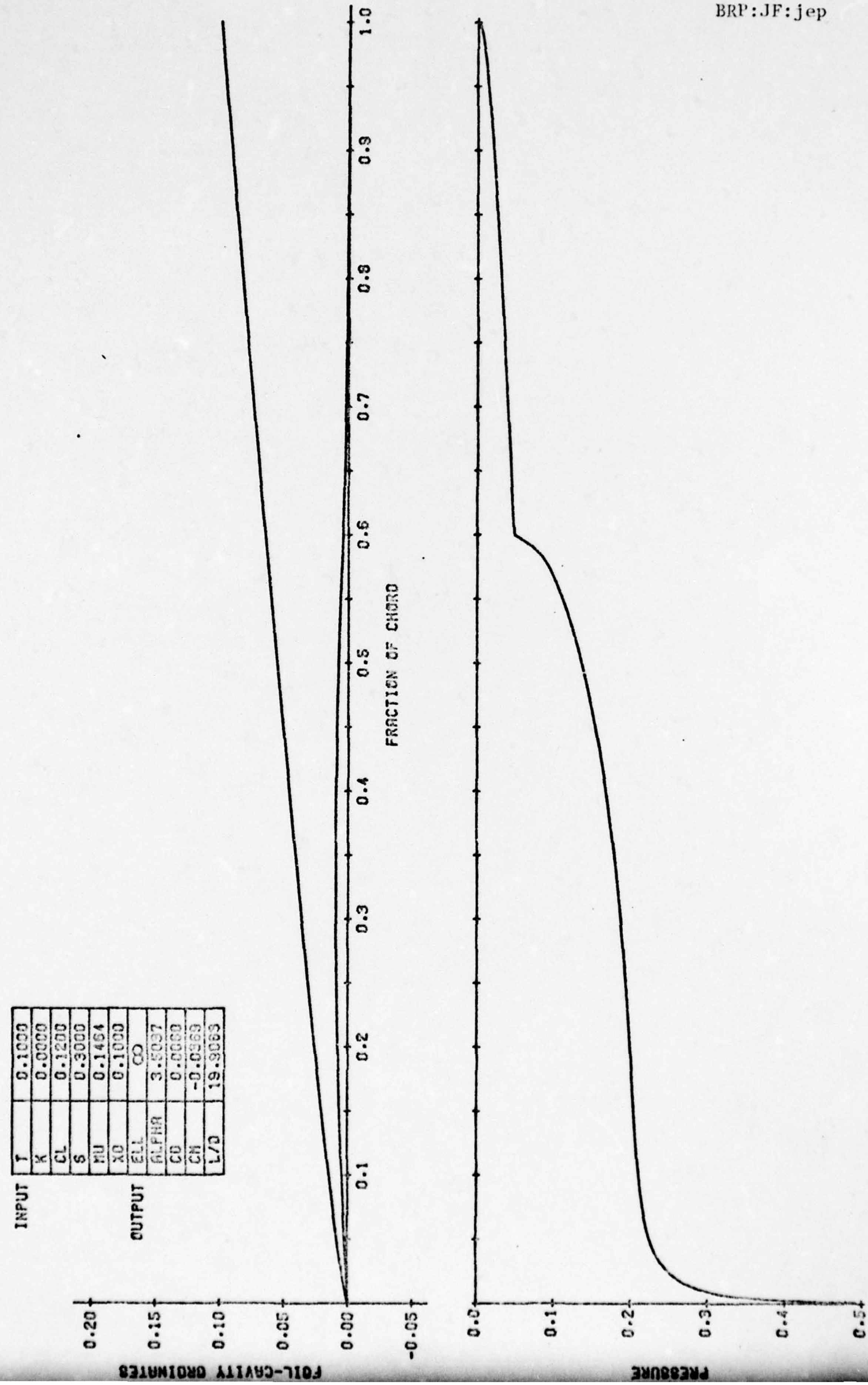


Figure 42 - Profile and Pressure Distribution for s=.3

5 July 1977
BRP:JF:jep

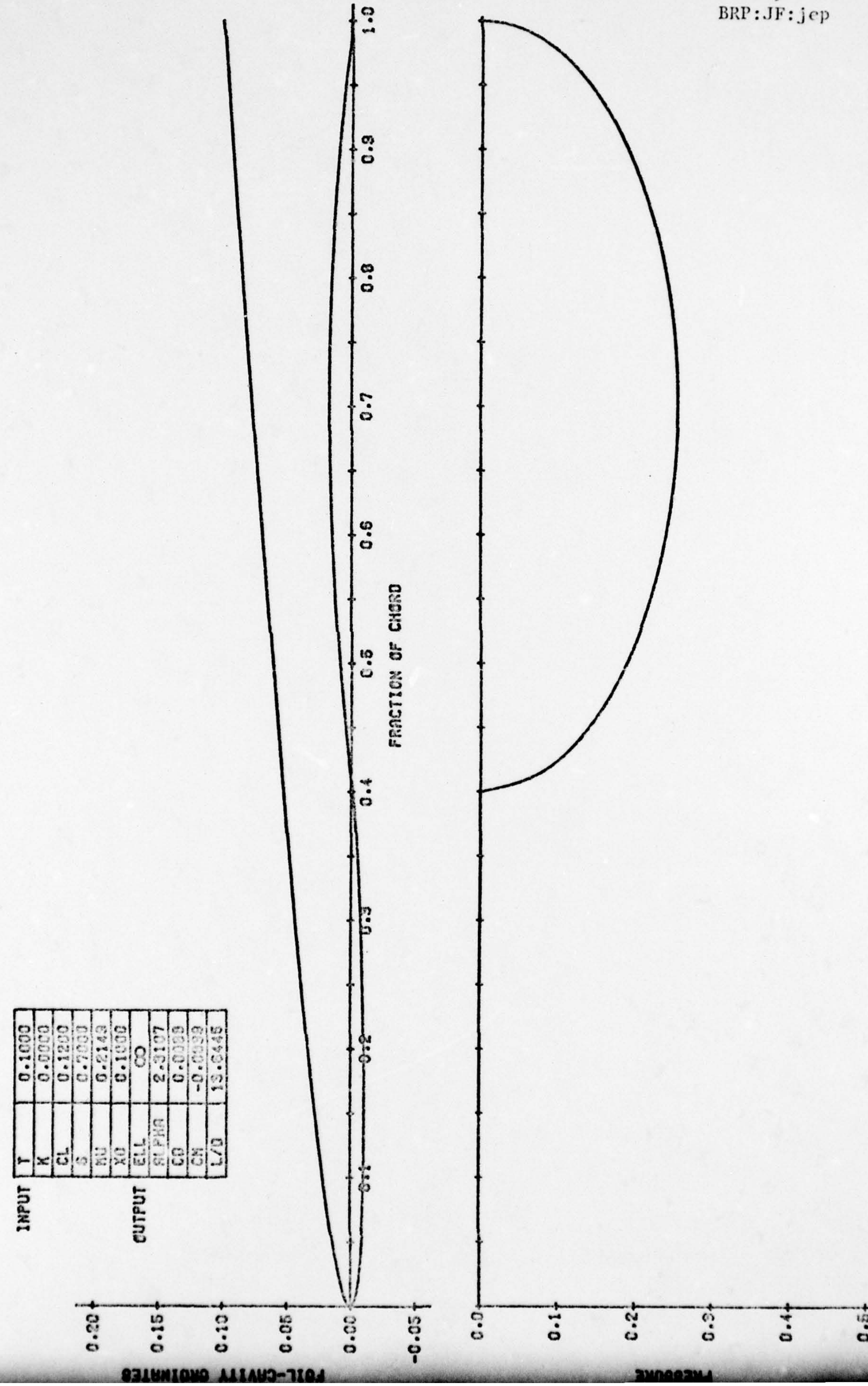


Figure 43 - Profile and Pressure Distribution for s=.7

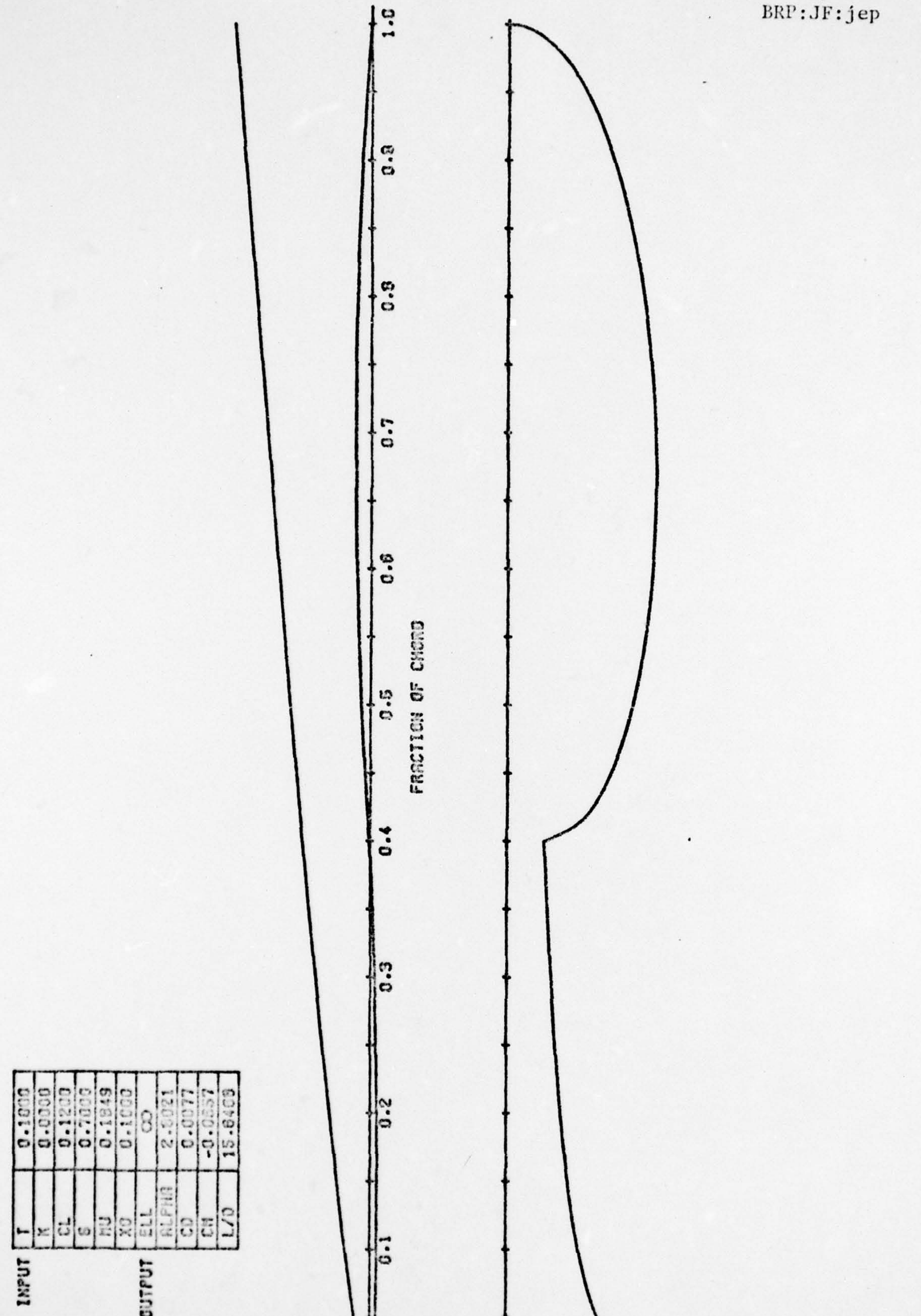


Figure 44 - Profile and Pressure Distribution for s=.7

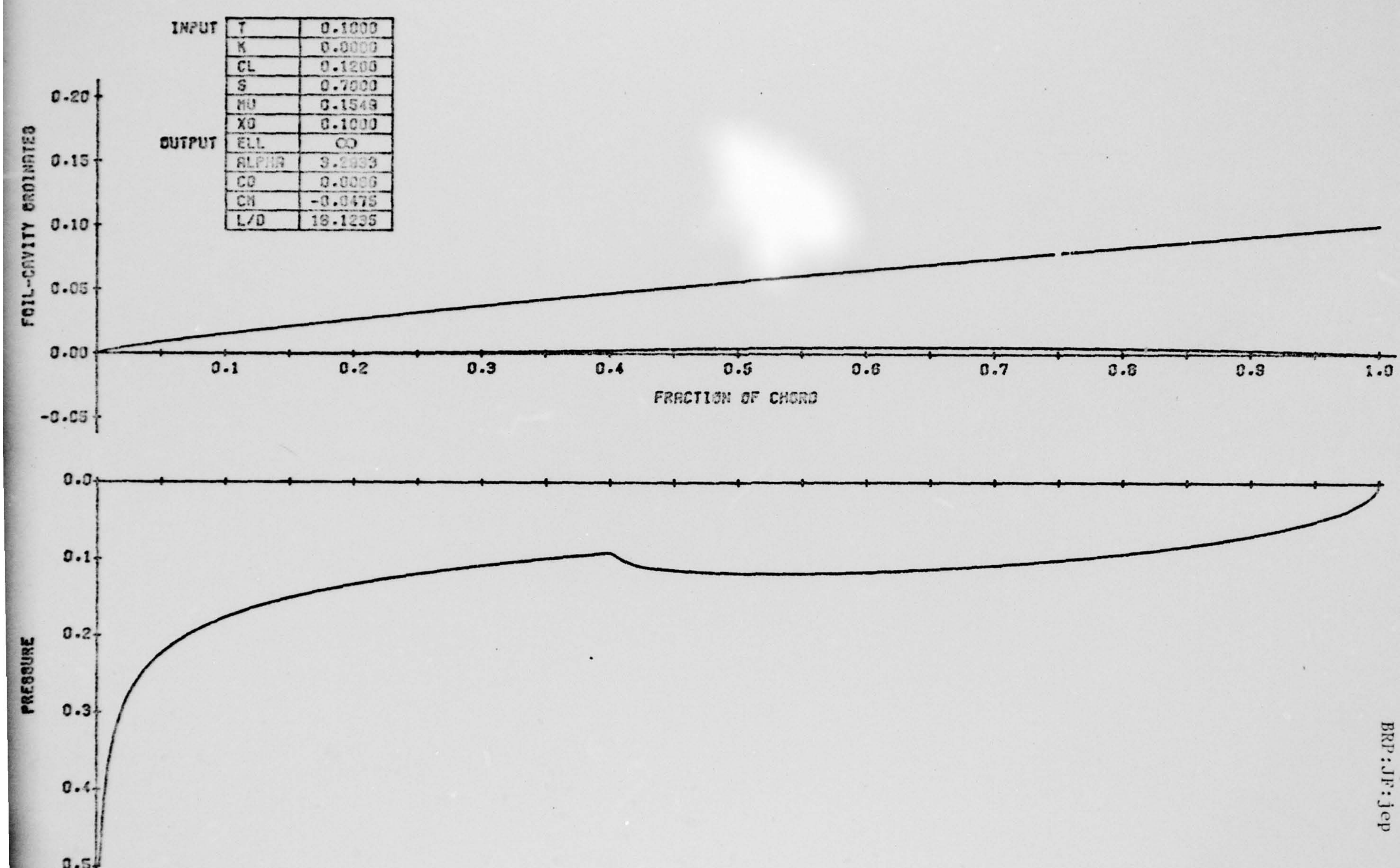


Figure 45 - Profile and Pressure Distribution for s=.7

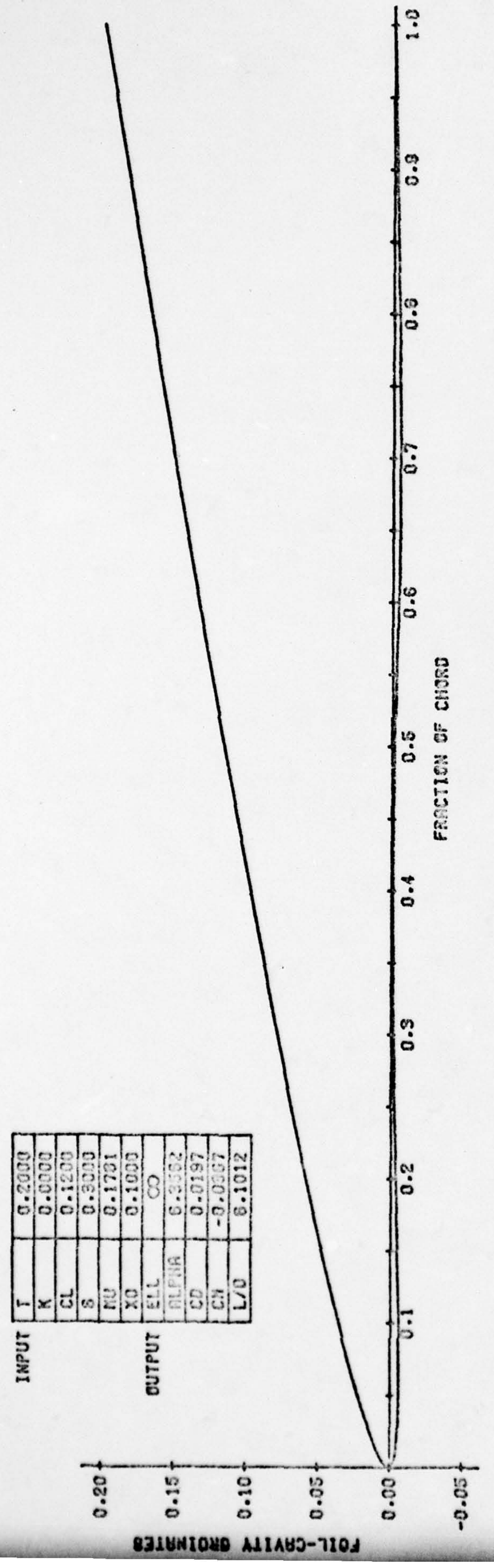


Figure 46 - Profile and Pressure Distribution for s=.3

5 July 1977
BRP:JF:jep

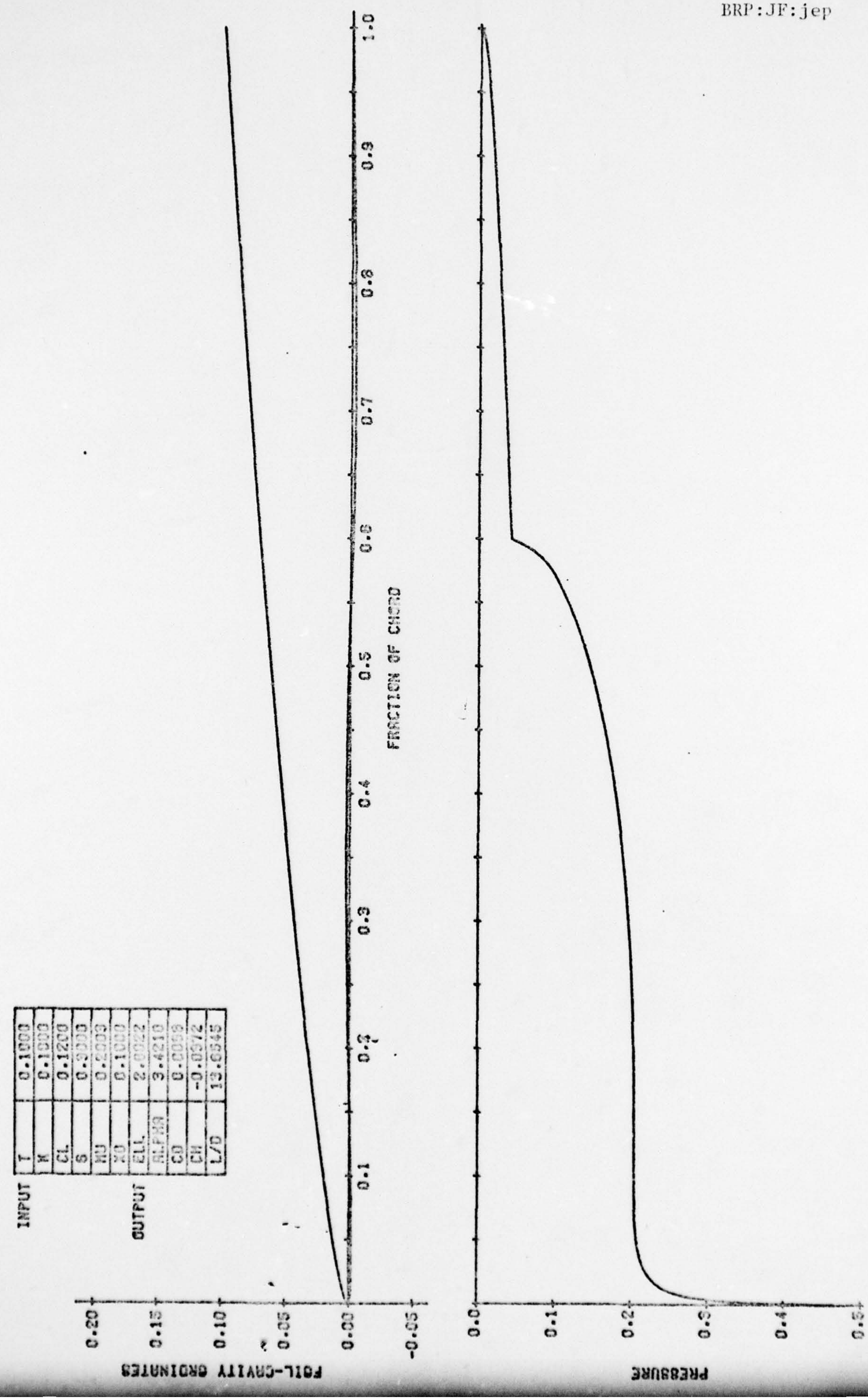


Figure 47 - Profile and Pressure Distribution for s=.3

5 July 1977
BRP:JF:jep

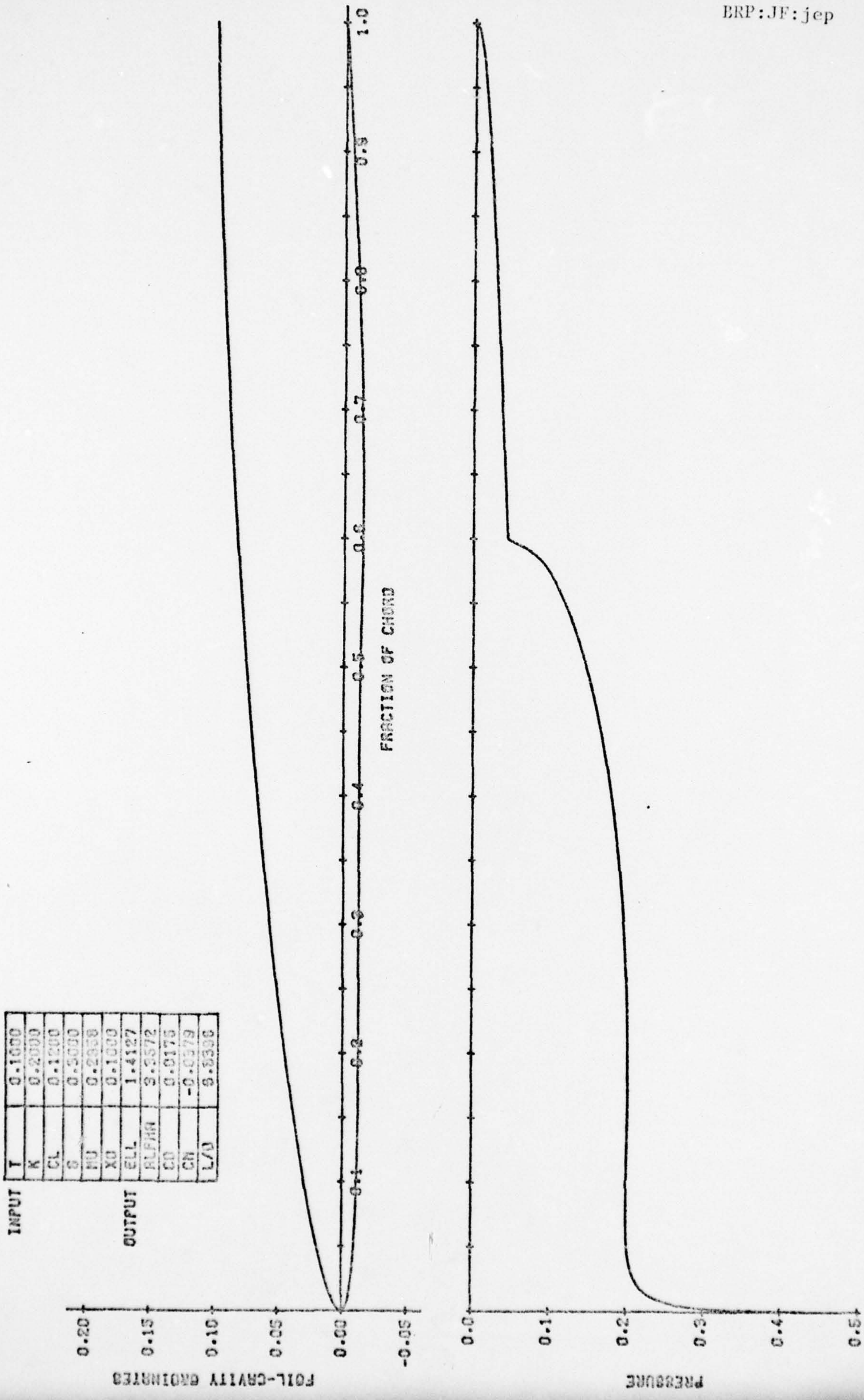


Figure 48 - Profile and Pressure Distribution for s=.3

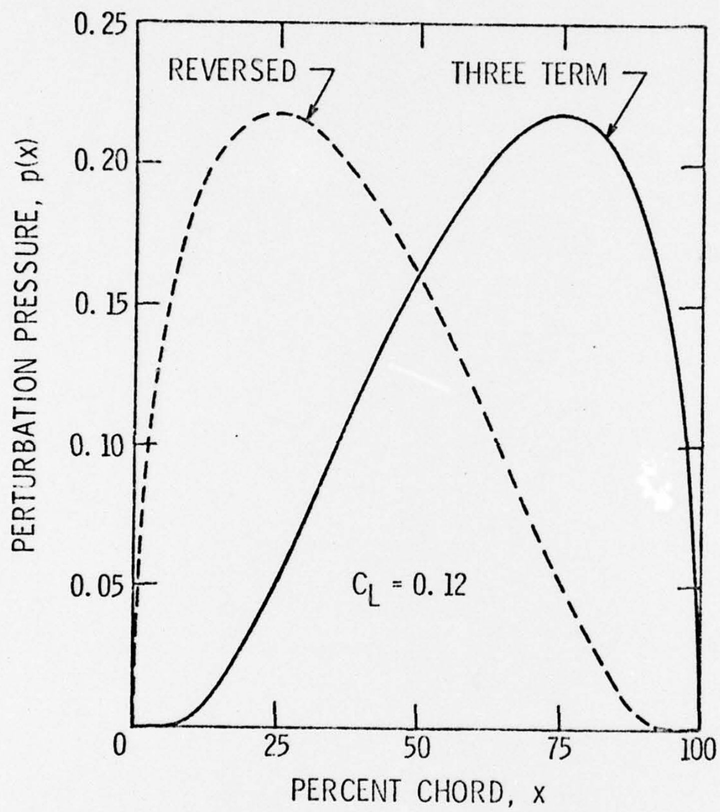


Figure 49 - Three-Term Pressure Distributions at C_L=.12

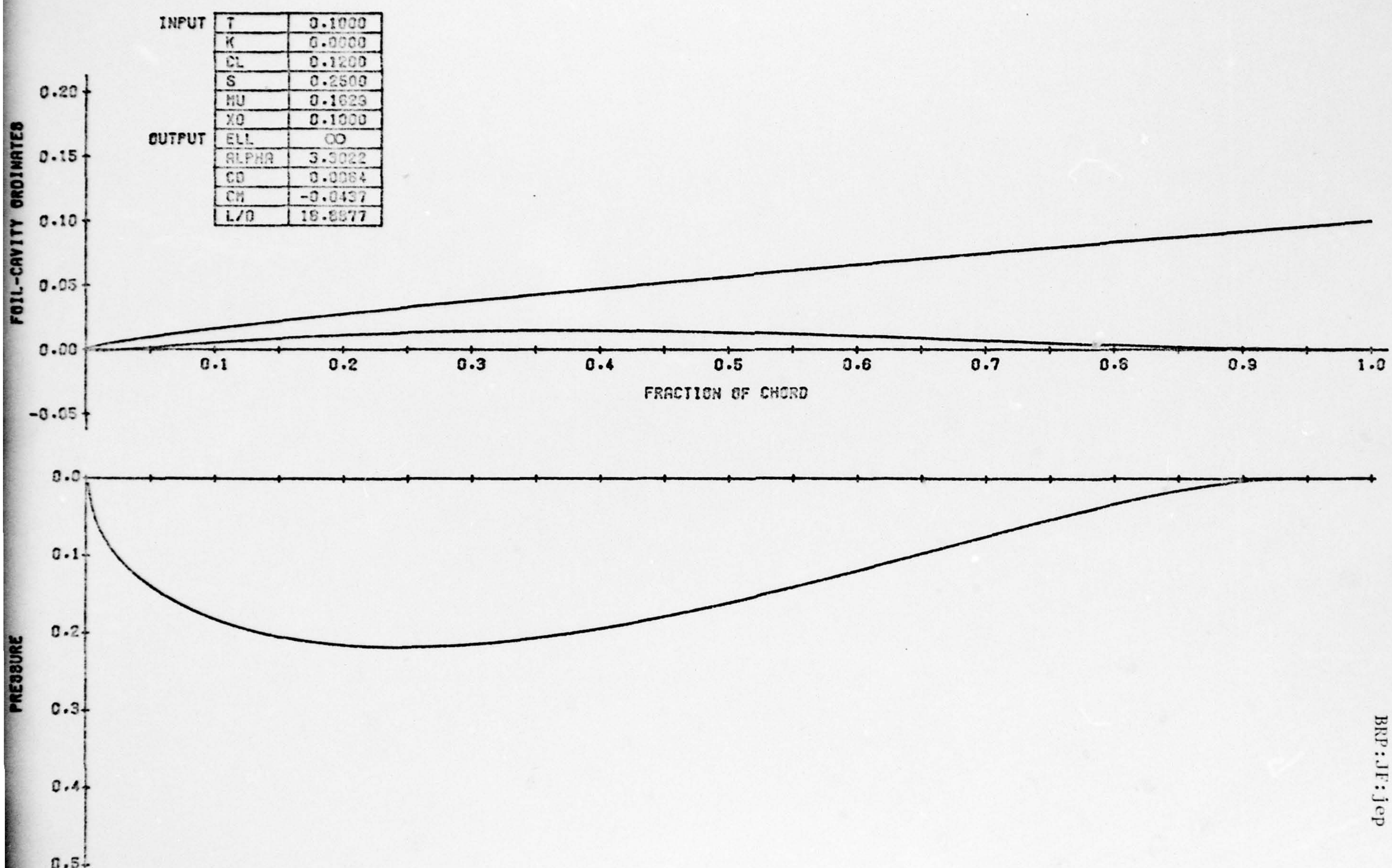


Figure 50 - Nose-Loaded Pressure Distribution and Profile
Shape for a Three-Term Profile

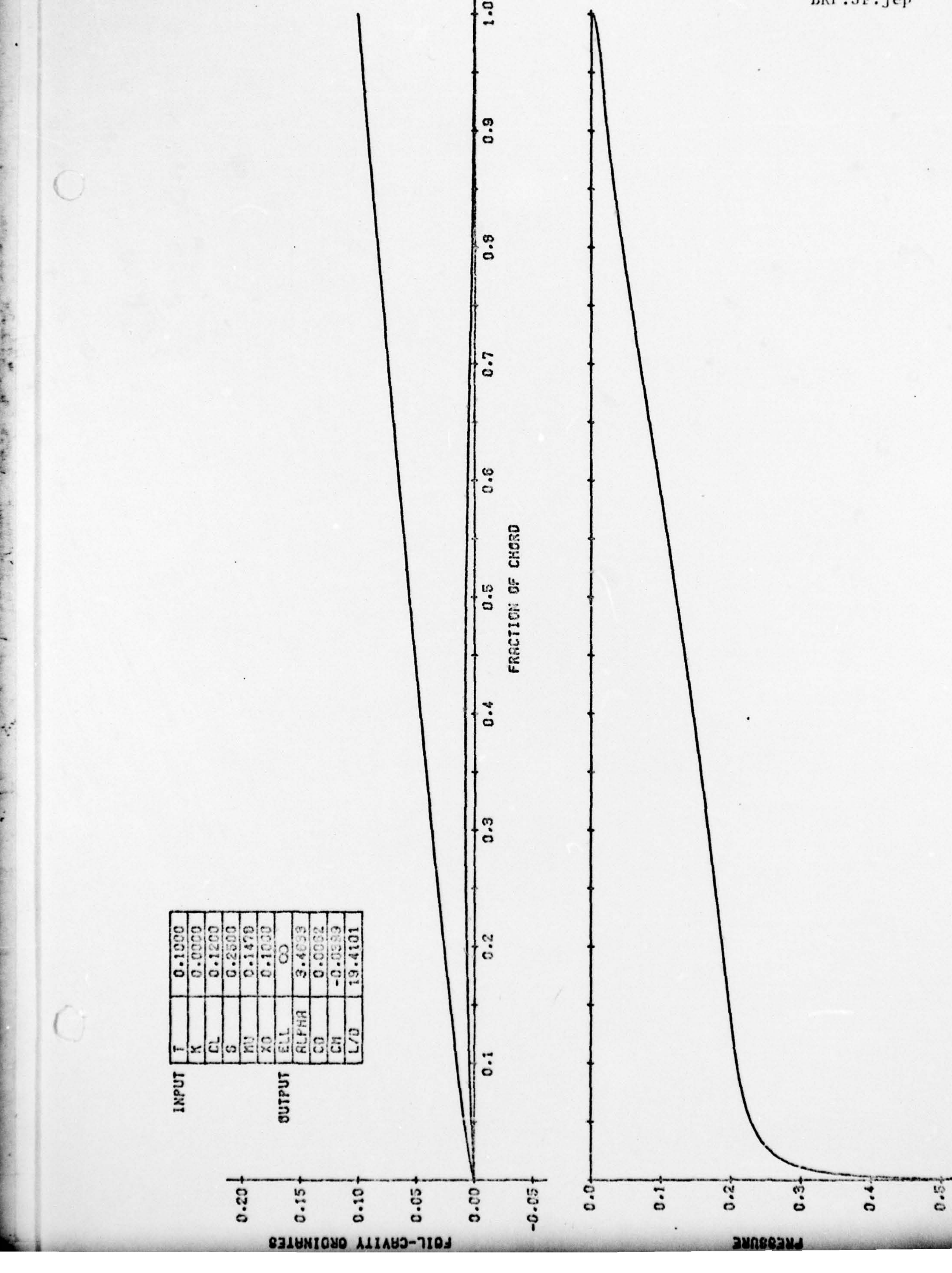


Figure 51 - Nose-Loaded Pressure Distribution and Profile Shape for a Three-Term Profile

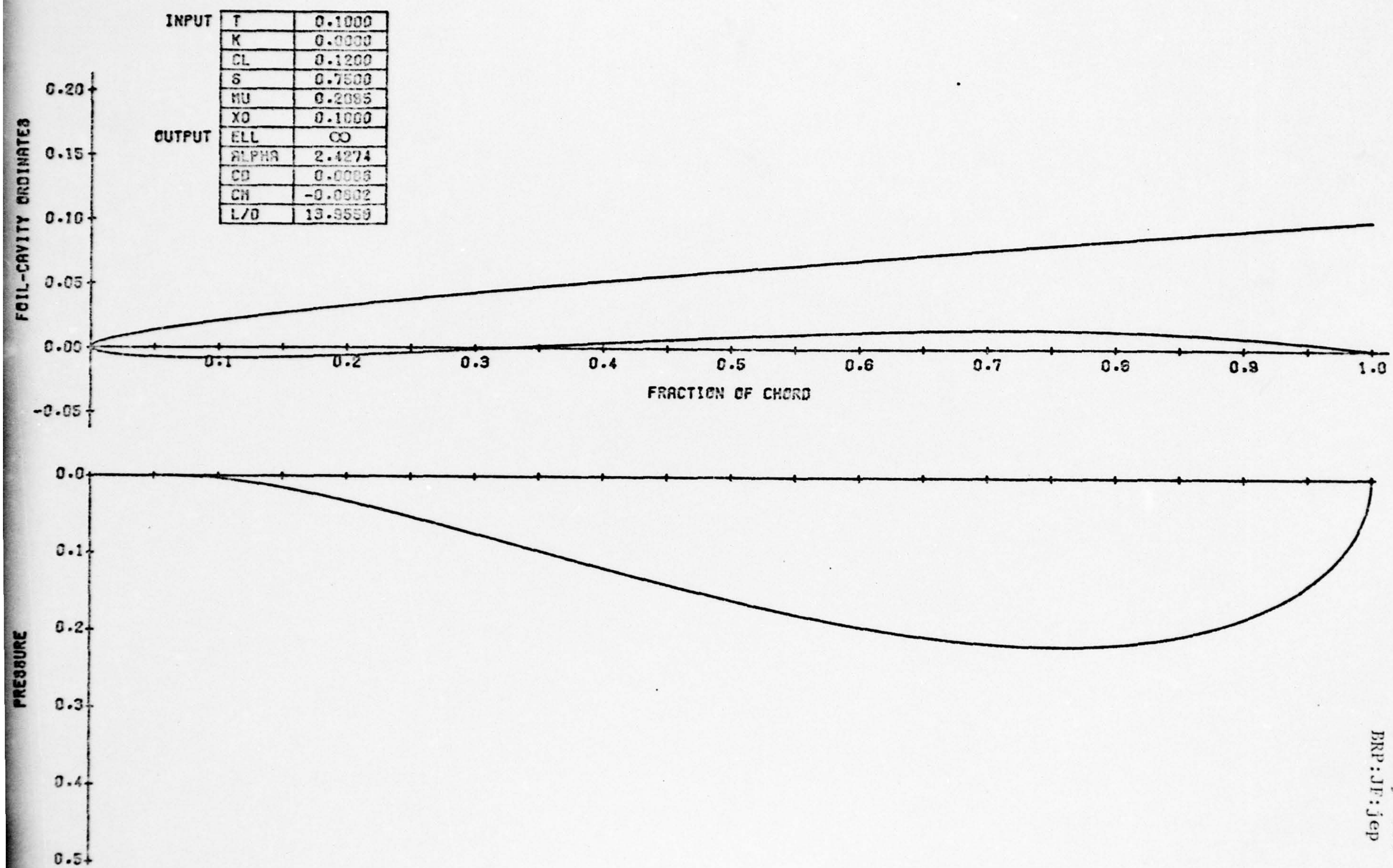


Figure 52 - Three-Term Pressure Distribution and Profile Shape for a Tail-loaded Hydrofoil

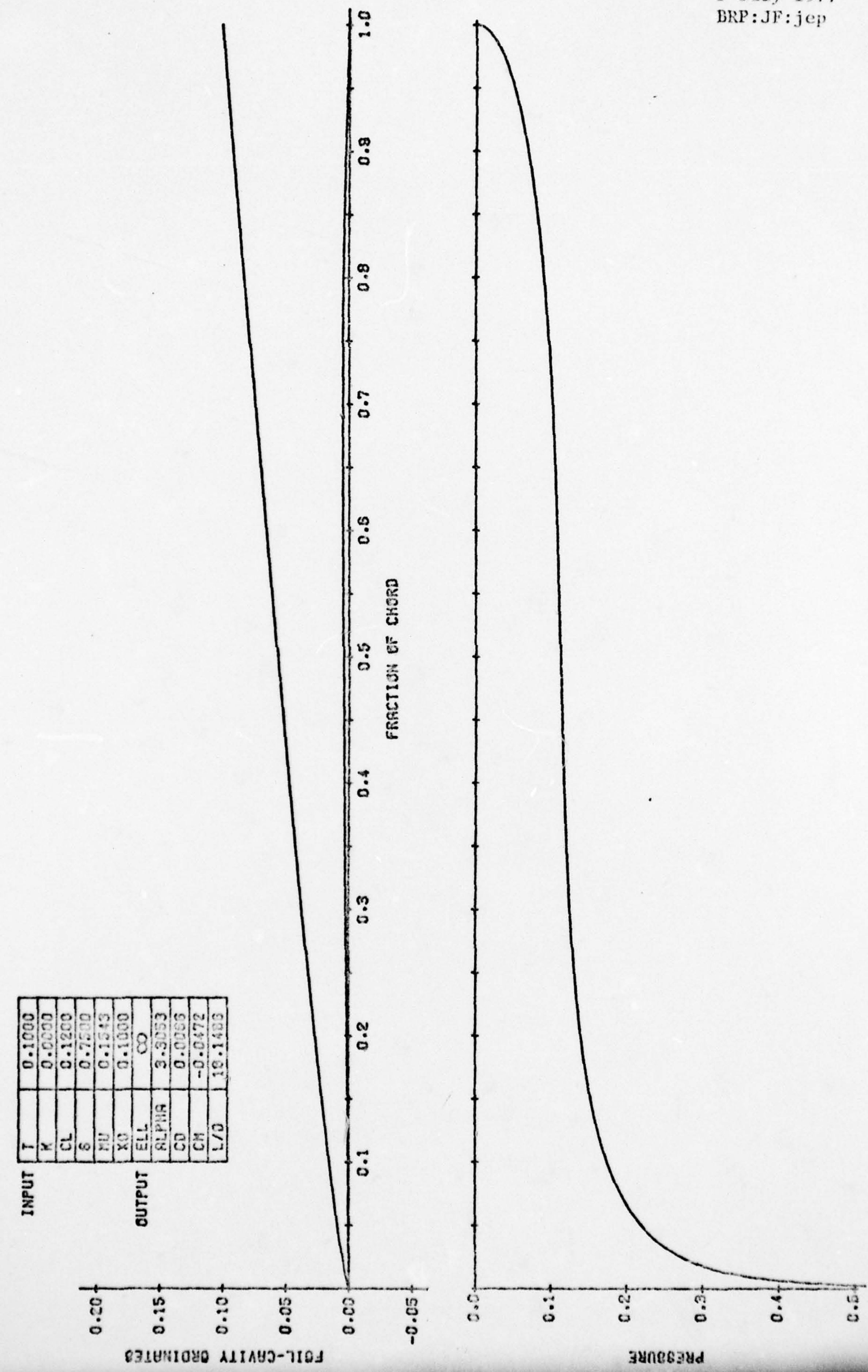
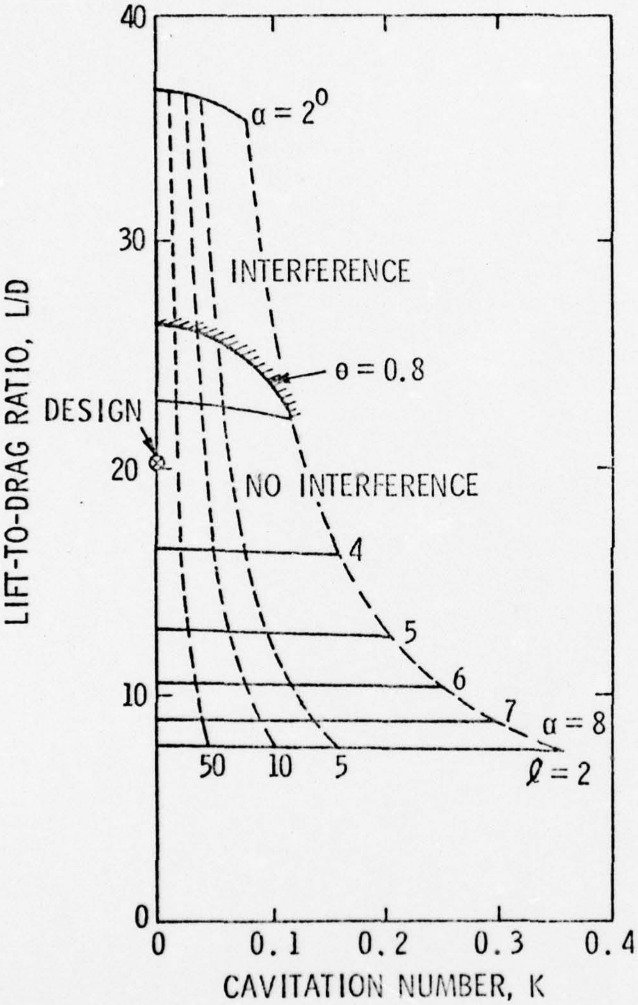


Figure 53 - Three-Term Prescribed Pressure Distribution and Profile Shape for a Tail-Loaded Hydrofoil



OFF-DESIGN CALCULATIONS

Figure 54 - Off-Design Characteristics for the Hydrofoil Section of Figure 40

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